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JOURNAL
OF THE
ASIATIC SOCIETY
OF
BENGAL.

EDITED
BY THE SECRETARY.

VOL. X.

PART II. JULY TO DECEMBER, 1841.

NEW SERIES.

" It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science, in different parts of *Asia* will commit their observations to writing, and send them to the Asiatic Society in Calcutta ; it will languish, if such communications shall be long intermitted ; and will die away, if they shall entirely cease."—SIR WM. JONES.

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1841.

CONTENTS.

No. 115.

	<i>Page.</i>
I.—On the Natural Products about the Pundeelah River, H. H. the Nizam's territory. By Dr. Walker, Madras Army,	509
II.—Report on the River Indus, (Sections 1 to 5.) By Lieut. Wood, Bombay Marine,	518
III.—A Sketch of the second Silver Plate found at Badakshân. By Alexander Cunningham, Esq.	570
IV.—Note by Capt. Hay, on a Bird Native of the Eastern Islands, undescribed (?) in a letter to the Editor,	573
V.—Examination of some decayed Oriental Works in the Library of the Asiatic Society. By H. Piddington, Esq. Officiating Curator, Museum Asiatic Society,	576
VI.—On Bos Gaurus. By W. Elliot, Esq. M. C. S., from Madras Journal of Literature,	579
VII.—Proceedings of a Special Meeting held at the Asiatic Society's Rooms,	587
VIII.—Proceedings of the Asiatic Society,	589

No. 116.

I.—Scheme of a Table for all Time. By Capt. R. Shortrede, Assistant Surveyor General,	595
II.—Notes on the Gems found at Beghram. By J. S. Chapman, Esq. Assistant Surgeon, 16th Lancers,	613
III.—Letter to the Secretary of the Asiatic Society on the Cataclysm of the Indus, from Dr. Falconer, Saharunpoor,	615
IV.—Note on the Fossil Jaw, sent from Jubbulpore by Dr. Spilsbury. By the Acting Curator, Mr. Piddington,	620
V.—Notes on Fossil Discoveries in the valley of the Nerbudda. By G. G. Spilsbury, Esq.	626
VI.—Catalogue of the Birds in the Museum of the Asiatic Society. By J. T. Pearson, Surgeon, formerly Curator of the Museum,	628

	<i>Page.</i>
VII.—Catalogue of Mammalia in the Museum of the Asiatic Society. By J. T. Pearson, Surgeon, Bengal Establishment; formerly Curator of the Museum,	660
VIII.—Inscription taken from a Baolee at Bussuntgurrh, at the foot of the Southern range of Hills running parallel to Mount Aboo. By T. S. Burt, F.R.S. Captain, Bengal Engineers,	664
IX.—Proceedings of the Asiatic Society,	674

No. 117.

I.—Account of Arakan. By Lieut. Phayre, Senior Assistant Commissioner, Arakan,	679
II.—Table of proportional Logarithms. By Captain Robert Shortrede,	713
III.—Memorandum on Nurma Cotton. By H. Piddington, Esq.	716
IV.—Report on some articles of Trade sent by Lieut. Postans from Khorassan. By H. Piddington, Esq.	718
V.—Note on the <i>Cervus Elaphus</i> (?) of the Sâl Forest of Nepâl Hodie, C. Affinis, nob. By B. H. Hodgson, Esq.	721
VI.—Notes and Observations in continuation from Dr. Walker, Madras Medical Service, on a tour in H. H. the Nizam's Territories,	725
VII.—A general Review of the Species of True Stag, or Elaphoid form of <i>Cervus</i> , comprising those more immediately related to the Red Deer of Europe. By Edward Blyth, Curator of the Museum of the Bengal Asiatic Society,	736
VIII.—Proceedings of the Asiatic Society,	751
IX.—Special Meeting held on the 24th September 1841, of the Committee of Papers,	755

No. 118.

I.—Description of a Persian Astrolabe, submitted to the Asiatic Society by Major Pottinger. By J. Middleton, Esq. Principal of the Government College at Agra,	759
II.—Notice of the Marmot of the Himalaya and of Tibet. By B. H. Hodgson, Esq. Resident at the Court of Nepal,	777
III.—Memorandum on the Organization of a Museum of Economic Geology for the North-Western Provinces of British India, to be established at Agra. By Lieut. W. Baird Smith, Bengal Engineers.	779
IV.—On a New Organ in the Genus <i>Moschus</i> . By B. H. Hodgson, Esq. Resident at the Court of Nepal,	795
V.—Extracts from a Report on subjects connected with Affghanistan. By Dr. Griffith, communicated to the Editor from the office of the Political Secretariat of India,	797
VI.—Description of another new species of <i>Pika</i> , (<i>Lagomys</i>) from the Himalaya. By Edward Blyth, Curator of the Asiatic Society.	816

	<i>Page.</i>
VII.—Literal Translation of the Vasanta-Gurh Inscription. By Pundit Surodaha Prasadh,	819
VIII.—Observations on a second Inscription taken in fac-simile from the neighbourhood of Mount Aboo. By Captain Burt, Bengal Establishment, F. R. S.	821
IX.—A letter to the Secretary, on the Nurma Cotton of Bundelcund, from J. G. Bruce, Esq.	822
X.—Letter to the Editor, on Liehens in the Himalayas, from Henry Cope, Esq.	828
XI.—Proceedings of the Asiatic Society	833

No. 119.

I.—Report on the Tin of the Province of Mergui. By Captain G. B. Tremenhære, Executive Engineer, Tenasserim Division.	845
II.—Report on the Manganese of the Mergui Province. By Captain G. B. Tremenhære,	852
III.—Of a new species of Lagomys inhabiting Nepal, (with Plate,) Lagomys Nepalensis, Nob. By B. H. Hodgson, Esq. Resident at the Court of Nepal	854
IV.—Notice of a new form of the Glaucopinæ, or Rasorial Crows, inhabiting the Northern region of Nepal, Conostoma Æmodius, (Nobis type.) By B. H. Hodgson, Esq. Resident at the Court of Nepal.	856
V.—A Monograph of the species of Wild Sheep. By Edward Blyth, Curator to the Asiatic Society of Bengal,	858
VI.—A connected view of the species of Lichens, with their Botanical relationship existing between them and the Indian productions. By Henry Cope, Esq.	888
VII.—A Fourth Memoir on the Law of Storms in India, being remarks and documents relative to the loss of the ship Golconda, in the Tyfoons of 22nd to 24th September 1840, in the China Sea. By Henry Piddington, Esq.	895
VIII.—Classified Catalogue of Mammals of Nepal, (corrected to the end of 1841, first printed in 1832). By B. H. Hodgson, Esq. Bengal Civil Service,	907
IX.—Proceedings of the Asiatic Society, for November,	917
X.—Proceedings of the Asiatic Society, for December,	935

No. 120.

I.—Report to the Secretary of the Board of Customs, Salt and Opium, on the Salts called Puckwah and Phool Kharee, with a process for detecting the adulteration of Government Salt, estimates of the quantities of both Salts annually produced, and of the amount of loss which the Revenue may sustain through the production of these two articles. By Henry Piddington, Esq.	939
II.—Remarks by Capt. J. T. Boileau, Bengal Engineers F.R.S., F.R.H.S., on the Construction of Newman's improved Portable Barometer, and on the mode of renewing the Guage Point when lost,	957

	<i>Page.</i>
III.—Observations of Meteors, on the night between the 12th and 13th November 1841, made at the Magnetic Observatory at Simla. Communicated by Captain J. T. Boileau, Engineers, F.R.S. &c. &c. Superintendent,	964
IV.—On Porcelain Clay found at Mangalore. By A. T. Christie, Esq. Madras Medical Service. Communicated by Government,	967
V.—Descriptions of three Indian Species of Bat, of the genus Taphozous. By Edward Blyth, Curator to the Asiatic Society,	971
VI.—Extracts from a Report on subjects connected with Affghanistan. By Dr. Griffith. Communicated to the Editor, from the Political Secretariat of India.	977
VII.—Grammar and Vocabulary of the Cashmiri Language. By M. P. Edgeworth, Esq., B.C.S.	1038

Index.

	Page.		Page.
Arakan Account of, By Lieutenant Phayre, Senior Assistant Commissioner, Arakan,...	679	the loss of the Ship Golconda, in the Tyfoons of 22d to 24th September 1840, in the China Sea. A Fourth Memoir on the, By Henry Piddington, Esq.	895
Articles of Trade sent by Lieut. Postans from Khorassan. Report on some, By H. Piddington, Esq.	718	Lichens in the Himalayas. Letter to the Editor on, from Henry Cope, Esq.	828
Bos Gaurus. On, By W. Elliot, Esq. M. C. S., (from Madras Journal of Literature,) ...	579	Literal Translation of the Vasanta-Gurh Inscription. By Pundit Surodaha Prasadh, ...	819
Cashmiri Language, Grammar and Vocabulary of the, By M. P. Edgeworth, Esq. B. C. S.	1038	Mammalia in the Museum of the Asiatic Society. Catalogue of, By J. T. Pearson, Surgeon, Bengal Establishment; formerly Curator of the Museum, ...	660
Catalogue of the Asiatic Society, Birds in the Museum of the, By J. T. Pearson, Surgeon, formerly Curator of the Museum,	628	Mammals of Nepal, Classified Catalogue of, (corrected to the end of 1841, first printed in 1832,) By B. H. Hodgson, Bengal Civil Service,	907
Cataclysm of the Indus. Letter to the Secretary of the Asiatic Society, On the, from Dr. Falconer, Saharunpoor,	615	Manganese of the Mergui Province, Report on the, By Captain G. B. Tremeneere, ...	852
Cervus Elaphus (?) of the Sâl Forest of Nepâl Hodie. Note on the, By B. H. Hodgson, Esq.	721	Marmot of the Himalaya, and of Tibet. Notice of, By B. H. Hodgson, Esq. Resident at the Court of Nepal.	777
Construction of Newman's improved Portable Barometer, and on the mode of renewing the Gauge Point when lost; with a drawing. Remarks on the, By Captain J. T. Boileau, Bengal Engineers, F.R.S., F.R.H.S.	957	Meteors on the night between the 12th and 13th November 1841, made at the Magnetic Observatory at Simla, Observations of, communicated, By Captain J. T. Boileau, Engineers. F.R.S., &c. &c. Superintendent,	964
Description of another New species of Pika, (Lagomys) from the Himalaya, By Edward Blyth, Curator of the Asiatic Society, ...	816	Natural Products about the Pundee-lah River, H. H. the Nizam's territory. On the, By Dr. Walker, Madras Army, ...	509
Fossil Discoveries in the valley of Nerbudda. Notes on the, G. G. Spilsbury, Esq.	626	New Organ in the Genus Moschus. On a, By B. H. Hodgson, Esq. Resident at the Court of Nepal,	795
Fossil Jaw, sent from Jubbulpore. Note on the, By the Acting Curator, Mr. Piddington.	620	Note and Observations in continuation from Dr. Walker, Madras Medical Service, on a tour in H. H. the Nizam's Territories, ...	795
Gems found at Beghrum. Notes on the, By J. S. Chapman, Esq. Assistant Surgeon, 16th Lancers,	613	Nurma Cotton, Memorandum on. By H. Piddington, Esq.	716
Glaucopinæ, or Rasorial, Crows, inhabiting the Northern region of Nepal—Conostoma Æmodius. Notice of a new form of the, By B. H. Hodgson Esq. Resident at the Court of Nepal, ...	856	Nurma Cotton of Bundelcund, a letter to the Secretary, on the, from J. G. Bruce, Esq.	822
Inscription taken from a Baolee at Bussuntgurh, at the foot of the Southern range of Hills running Parallel to Mount Aboo, By T. S. Burt, F. R. S. Captain, Bengal Engineers,	664	Organization of a Museum of Economic Geology for the North-Western Provinces of British India, to be established at Agra, Memorandum on the, By Lieut. W. Baird Smith, Bengal Engineers, ...	779
Lagomys inhabiting Nepal, (with Plate.) Of a new species of, By B. H. Hodgson, Esq. Resident at the Court of Nepal, ...	854	Oriental Works in the Library of the Asiatic Society. Examination of some decayed, By H. Piddington,	
Law of Storms in India, being remarks and documents relative to			

	Page.		Page.
ton, Esq. Officiating Curator, Museum Asiatic Society, ..	576	Second Silver Plate found at Badak- shân. A Sketch of the, By Alexan- der Cunningham, Esq.	570
Persian Astrolabe, Description of a, submitted to the Asiatic Society, By J. Middleton, Esq. Principal of the Government College at Agra,	759	Species of Lichens, with their Bota- nical relationship existing between them and the Indian productions. A connected view of the, By Henry Cope, Esq.	858
Porcelain Clay found at Mangalore. On, By A. T. Christie, Madras Medical Service, Communicated by Government,	967	Species of True Stag or Elaphoid form of Cervus. A general review of the, comprising those more im- mediately related to the Red Deer of Europe, By Edward Blyth, Cu- rator of the Museum of the Bengal Asiatic Society,	736
Proceedings of the Asiatic Socie- ty, .. 587-589-674-751-755-833-917	935	Table of Proportional Logarithms, By Captain Robert Shortrede, ..	713
Report on subjects connected with Affghanistan. Extracts from a, By Dr. Griffith, communicated to the Editor from the office of the Poli- tical Secretariat of India,	797-977	Three Indian Species of Bat, of the genus Taphozous. Descriptions of, By Edward Blyth, Curator to the Asiatic Society,	971
River Indus, (Sections I to 5.) Re- port on the, By Lieutenant Wood, Bombay Marine,	518	Tin of the Province of Mergui. Re- port on the, By Captain G. B. Tre- menheere, Executive Engineer, Tenasserim Division, ..	845
Salts, called Puchwah and Phool- Kharee. Report on, By Henry Piddington, Esq.	939	Undescribed Bird, Native of the Eas- tern Islands. Note on a, By Captain Hay, (?) in a letter to the Editor,	573
Scheme of a Table for all Time. By Captain R. Shortrede, Assistant Surveyor General, ..	595	Wild Shecp, a Monograph of the Spe- cies of, By Edward Blyth, Curator to the Asiatic Society of Bengal,	858
Second Inscription taken in facsi- mile from the neighbourhood of Mount Aboo. Observations on a, By Captain Burt, Bengal Esta- bilshment, F.R.S. ..	821		

ADVERTISEMENT.

The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensgmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohehoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the re-

markable Sauriens of Muschelkalk (*Nothosaurus*, *Pistosaurus*, *Charitosaurus*, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to the number at present only, we are able to estimate the riches of the whole creation, and to explain the alternations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°. with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

HERMAN VON MEYER.

JOURNAL

OF THE

ASIATIC SOCIETY.

On the Natural Products about the Pundeelah River, H. H. the Nizam's territory.—By DR. WALKER, Madras Army.

I marched from Pakhall on the 7th instant in a North-westerly direction towards Madhapore, which I reached on the 13th. I remained there for five days, when I proceeded to this place, deviating from the direct route by going ten miles up the Pundeelah river.

At Dogundah, the first stage on the march from Pakhall, so deep was the soil, that I experienced considerable difficulty in procuring a specimen of the surface rock. Upon obtaining one, I found it to consist of sienitic granite, with a considerable quantity of mica interspersed. One of those greenstone veins so commonly met with, was found traversing the rock in the usual direction from East to West to near the next stage, Korapack. Here, in some places of the plain, the granite was observed to lose its hornblende and mica altogether, and become the pegmatite of French writers. The great proneness of the felspar to decompose in this form of granite, is shewn by the brackish water of the neighbourhood; and here it may be remarked that, within the tropics, where from the great heat and other causes, there is a continual tendency to decomposition and recomposition, it necessarily appears that wells sunk in rocks containing alkali, particularly if lime is present in the soil, must ever contain water more or less impure, and that the impurity will always be found in a direct ratio to the facility with which the rock disintegrates. It must also follow as a consequence, that the older the well

is, the worse the water; for the salts that occasion the brackishness are by no means removed on their contents being drawn out, or evaporated; but adhere to the sides of the well, or being extremely soluble, as they all are, impregnate the bottom mud to some depth. May not the proverbial unhealthiness of old deserted cities be in a great measure attributable to the water reservoirs being all in the same state?

At the next stage, Gunpoora, the elevations to the right were ascertained to be of the sandstone formation, similar to that of Pakhall. The granite continued for some miles to be the surface rock; but it finally disappeared at Chintakaminah, the stage next to Madhapore, where its place was taken by the sandstone.

Between Senapore and Madhapore, the country, particularly after entering the Chinnore Sircar at Chumblepore, is exceedingly jungly. The wood jungle, which commences at the last mentioned place, consists of the trees formerly noticed in the description of Pakhall, with the addition of two or three Gardenias. Two species of Bignoria, the *crispa* and *quadulocularis*, the *Schrebera Swietenoides*, a species of *Cordia*, the *Strychnos Potatorum*, the *Randea dumetorum*, the *Terminalia Chebula*, two species of *Casearia* and *Celastrus raniculata*; the last a climbing shrub. Of the grains and legumes cultivated in this Sircar, there is little or no difference between them and those of Hunumkondah, mentioned in my first letter. The *Linum usitatissimum* is grown here in small quantity, but a good deal is imported from Chandah. Its oil is chiefly used by the sawyers.

A species of *Capsicum*, known in Western India by the name of Nepal chilly, is grown here. Cotton is also raised, but in very small quantity. The Goands who inhabit the hills and fastnesses of the north, use the bamboo seeds, ground to a meal, and mixed with milk, as an article of diet. Cattle, buffaloes included, present nothing remarkable. The latter, as elsewhere in other parts of India, are used for draught.

There are flocks of sheep, with the brown wool, here; it is not esteemed of much value, and is chiefly sent to Chandah in the Nagpore territory. The Goands bring in hides of the Samber* and Nilgye† for sale; the price is from eight annas to twelve annas each.

* Samber or Samur. The Indian Elk.

† Nilghye.

The principal manufacture throughout this district is the tusser or jungle silk. The tusser *breeders* are a class quite distinct from the weavers, and are either Telongoos of low caste or Goands; the former reside principally at Chilpore, Madapore, and Chinnore. At Madapore, which may be regarded as the centre and head quarters of the tusser-breeders, there are at least seventy families.

The tusser-breeder never thinks of keeping up the breed of the insect throughout the year. When the leaf is off the tree, about the middle of March, he deems his occupation gone, and he leaves the object of his former excessive care to shift for itself, thinking of nothing but his present ease, which may be summed up in a few words, —sloth, a bare subsistence, and an occasional debauch in his nectar, *palm toddy*. But with the rains returns his toil, and some little difficulty is experienced in procuring insects for a fresh campaign. If he can gather a dozen of promising cocoons, which his experience tells him are of females, he is quite satisfied. Carefully does he watch the bursting of the cocoon, and much care does he take of its winged inmate, having previously prepared for it a house of teak leaves dried. The male is not tardy in approaching.

Impregnation takes place, the male dies, and in four days after laying her eggs, the female also. The eggs are in number about sixty, of these one-half prove abortive, while the others are hatched in ten days. The small insect is fed on the tender leaves of the *Careya sphærica*, and in six weeks spins its cocoon; the first brood are spared and allowed to burst their cocoons to supply a sufficient quantity of ova for the first tusser harvest; the same process as described is again gone through, with this exception, that the young worms are this time fed on the leaves of the *pentaptera tomentosa*, as those of the *Careya sphærica* are, by the period of the season, supposed to have acquired some influence noxious to the insect. It is during the progress of the worm, from the egg to the formation of the cocoon, that every energy of the tusser-breeder is called into action for the preservation of his charge. Every animal, footed, winged, and creeping, is said to be the enemy of the tusser grub. Ants destroy them, kites and crows prey on them, snakes devour them, and squirrels are said to make a repast of them. To protect them first from their insect enemies, the tusser-breeder ascends the Muddy tree, (*Pentaptera tomentosa*,) the

leaves of which are the insect's food ; every branch he carefully clears of the different species of ants by which they may be infested, preventing the access of others, by surrounding the trunk of the tree at its foot with ashes. The other enemies are kept off by shouting, throwing stones, firing guns, &c. Their life at this time would appear, by their own account, to be one of the most unremitting toil ; to devote themselves to which they forswear not only every indulgence, but every comfort ; and it rouses the apathetic peasant of *Telengana* to eloquence, when he recounts what privations he undergoes, what pleasure he derives himself, and what incessant labour he incurs while watching the rearing of the worm, and the perfecting of its work. The tusser butterfly is a species of *Saturnia*, probably the *aphia* described by Dr. Helfer as the most common of the native species. I send a specimen of a female moth.*

From four to five hundred of the cocoons are sold to the *Bunnyas* and weavers for one rupee ; the moth is killed by means of heat. There are three tusser harvests, one at the end of the rains, the other two in the cold season. The winding of the silk is accomplished by boiling the cocoons, separating the floss of which no use is made, and twisting eight or ten filatures from as many cocoons on the middle of the thigh with the left hand to be wound on the instrument, of which a muster is sent : this instrument the middle bar of the wood is held lightly in the hand of the workman and made to move in a semicircle. An ounce and a quarter of silk is the average daily winding of a single workman ; his wages are, at the common rate of one pice for winding the silk of fifty cocoons, about three pice a day, as he cannot wind more silk than from a hundred and fifty cocoons. The pice, however, are large, and go there by eight to the rupee.† The only dyes used for the tusser silk, as far at least as my observation or inquiry has gone, are the flowers of the palas and turmeric ; by the former the usual familiar colour is produced, by the latter a golden yellow is brought out after the threads are for some time immersed in a solution of ashes. The warp threads are stiffened with rice congee.

WAX.—A good deal of honeycomb is brought into Madhapore and Chinnore by the hill people. It is quite impossible, under the present

* This has not reached us, but it would be very curious to know, if that of Assam, described by Dr. Helfer and Mr. Hugon is the same as this of Hunumkonda. Ed.

† So in MSS.

circumstances of limited demand, to say what further supply these jungles might afford. The honey is sold for ten seers the rupee, and sent to Hyderabad. After the rains, and during the cold season, six or seven seers of wax can be purchased for a rupee.

It may here be mentioned, that the seer of both this and the Sircar of Hunumkondah, consists of fourteen thousand two hundred and twenty-seven grains, that is, about half an ounce more than two pounds. The maund is equal to twelve seers.

LAC.—The jungles in the Sircar, by report, yield this substance in abundance ; but the little demand comparatively speaking, induces few traders to encourage the hill people to bring it in. It is thus impossible to say what the actual supply of Lac really might be without traversing the jungles at the proper season ; but there can be little doubt that it would be ample. A specimen of it is sent.

GUMS.—East India Gum has obtained the bad fame of almost every East Indian production not under the direct superintendence of Europeans. It is called a spurious inferior article ;—the cause is obvious—the collectors mingle all sorts together, and there being no one to select from the chaos they bring in, to check the admixture of good and bad, or to fix a value on the article, they go in this state to the European market with the brand of East Indian. They are soon found, like all mixtures, to be inferior, and the original prejudice acquires at once the stamp of currency, the cause of their inferiority being wholly overlooked. The value of gum depends on its whiteness and solubility. Who has ever separately tested the solubility of the Gums now sent ? at least three of them are not even mentioned in botanical works ?

Gum 1.—*Conacarpus latifolia*. This is used by the tusser weaver.

Gum 2.—*Terminalia tomentosa*.

Gum 3.—*Terminalia bellerica*.

Gum 4.—*Buchanania latifolia*.

Gum 5.—*Garuga pinnata*.

Gum 6.—*Cochlospermum gossypium*.

Gum 7.—*Sterculia urens*.

The two last are nearly similar in their properties to gum tragacanth, and the gum of the *Sterculia urens* was actually used for some time as a true *Astragalus* gum ; there can be little doubt but that both are still constantly substituted for it.

It is difficult to say with any exactness, at what price these gums might be procured from the collectors, as the *Bunnyas* are very partial to the truck system, and rarely pay in money if they can avoid it; a state of things almost natural in a country like this where money is scarce.

GUM RESIN.—Frankincense of the *Boswellia thurifera*, the olibanum of the ancients. Of this a specimen is sent. The tree is very common in the jungles.

RESINS Decamully.—This substance, formerly accounted a gum, has been fully proved to be a resin. It is the produce of three species of *Gardenia*, all exceedingly common.

I am not aware that this article is yet employed for any economical purpose, but it is a substance that certainly deserves the notice of the artisan. It is very much used in native medicine.

OILS.—Both varieties of the *sesamum* plant, black and white, are cultivated, and from the seeds of the *Bassia latifolia* and *Balbergia latifolia*, oils are expressed and used for common purposes. Two varieties of the castor-oil are cultivated. I made a trial of the quantity of oil that the kernel of the nuts of the *Buchanania latifolia*, (*Chirongy*,) would yield, and obtained an English pint from two seers of seed.

This is an oil seldom or ever used by the natives. If it possesses the drying quality of nut oils in general, it may become a valuable article of commerce. The kernels of the *Chirongy* nuts are purchased at Madhapore, from six to eight seers the rupee.

The oil-press by which the oil was obtained, was of the simplest construction. It consisted of two logs of teak, with a hole in the extremity of each, through which passed a stake fixed in the ground, the other two ends were left free, and rested on the bifurcation of a strong piece of timber shaped like the letter Y. This was also fixed in the ground; the kernels were placed in a small bag formed of the liber of the *Sterculia urens*; they contained about half a pound, and were set one above another at the middle of the lower beam, pressure was then made by means of rope tied round the free extremities; this was done four or five times, the position of the bags being altered each time. The whole apparatus did not cost half a rupee; by it the *Mowah* oil is always expressed in this part of the country. The oil mill is used for most of the cultivated oil seeds, and castor-oil is obtained in the usual mode, by pounding and boiling.

ARTICLES OF THE MATERIA MEDICA.

Justicia Paniculata (CREYAT).—This drug, which forms the active ingredient of the celebrated French nostrum *Droque-amere*, grows in great abundance here. It is an excellent bitter and febrifuge.

STRYCHNOS POTATORUM.—This tree is found in the jungles; the peculiar property possessed by its seeds of rendering turbid water clear, might perhaps be turned to some account in the arts. It possibly depends on Bassorine, known to be an ingredient in the seed of more than one of its congeners. The *Nux vomica* tree is very common, as is also the *Celastris paniculata*, the seeds of which yield the celebrated black oil, (*Oleum nigrum*,) of Dr. Herklots. Two or three mucilaginous roots were shown me; one of these was that of *Asparagus acerosus*, another was most probably the root of the *Curculigo orchiodes*. The *Asclepias procera* was, as usual, very common, likewise the *Asclepias pseudosarsa*, country Sarsaparilla. The tuberous roots of two wild species of *Dioscorea* were brought; one of these, *Dioscorea oppositifolia*, has been found to yield a good arrow-root.

DYES.—The *Oldenlandia Umbelata* (Cherwil) grows wild here, as well as in the Hunumkondah Sircar. The bark of the *Morinda exerta*, which grows in the jungle, is also employed to dye red. A suggestion lately made by Mr. Solly of London, of making extracts of dye woods and barks, would be applicable to a bulky material like the present. The *Crotum plicatum* grows in great luxuriance on the alluvial soil on the banks of the rivers.

TIMBER.—Madhapore is the great dépôt for timber, chiefly teak, that is floated down by the rivers from the Nagpore country. Ebony trees are found in the jungle to the south of this. The *Schrebera Swietenoides*, the wood of which is said not to warp, grows to be a fine tree, and is abundant. All the valuable timber trees mentioned in my last letter, are to be met with.

CORDAGE.—The common Sunn plant, the *Crotolaria juncea*, is cultivated, and its fibres are made use of for many purposes as hemp. The fibres of the inner bark of two species of *Bauhinia* are twisted and used as rope, particularly by the Brinjarries; the inner bark of the *Butea superba* is also employed for the same purpose. I send a specimen of the rope made from the last.

The *Asclepias Tenacissima* of Roxburgh is found here. It is well known to yield very strong fibres, the strongest indeed of any plant

known. The fishermen in the rains collect it, beat out the fibres, and twist them for their nets. I shall endeavour, although the plant is out of season, to procure a specimen of this hemp, which I shall forward; and I have left directions at Chinnore, that a parcel be sent to Hyderabad, towards the end of the rains; at which time the plant is gathered, that a comparison be instituted between its strength and that of the various hems, whether the produce of this country or of Europe. It is also said to yield a species of caoutchouc. I propose starting from Chinnore *en route* to Cummurret this evening.

Note on Timber.

Although valuable teak is not the produce of this part of the Nizam's dominions, (for the greater part growing here is adapted solely for props and rafters,) yet as Madhapore is the great depôt from which the wood is sent to Hyderabad, &c. a brief notice respecting it may not be deemed out of place. The teak (*Tectona grandis*) grows to a large size in the country to the north of Chinnore, about eighty miles distant; chiefly in the territory of the Raja of Nagpore, along the banks of the streams tributary to the Pundeelah. Other valuable timber, particularly the *Diospyrus melanoxylon*, yielding black ebony, and another species of *Diospyrus* yielding green, a *Dalbergia* called by the natives *shesum*; but which may not, however, be the real sissoo, but rather its near ally the *Dalbergia latifolia*, for from such observers accuracy the distinguishing species is not to be expected—all these different woods were floated down some years ago by the house of W. Palmer and Co., but at the present time teak, and a very small quantity of shesum, are the only kinds cut. I have merely native report as to the extent of the forests yielding these woods, but they are described as of great extent. During the dry months the teak-trees are felled—they are conveyed sometimes on carts, but more frequently by bullocks yoked to them to Eeroo, or Agree, a village fifty miles up the Pundeelah from its junction with the Godavery. Nullahs in the rains are also taken advantage of for the same purpose. It is well known, that the natives prefer the period when the moon is on the wane for cutting timber, assigning as a reason, its liability to be attacked by insects when cut at the period of the moon's increase. When we acknowledge, as is now usually done, lunar influence

on the animal kingdom, we must be slow to deny its power on the less perfectly organized vegetable, and hence we must regard this practice as not the mere result of ignorance or prejudice; but must class it in the catalogue of facts to be investigated. With teak, however, it is remarkable that no period of the moon is observed, being cut without reference to any such time, as they allege that the oil contained in it, is protection sufficient against the common casualties to which other timber is subject.

At Teroo, the teak is barked, squared, and dried. From the beginning of the rains until February it is floated down in rafts, and landed principally at Madhapore, although still a certain quantity passes on to Rajamundry and Masulipatam. The raft consists of three tiers of wood placed across each other, and firmly bound together with ropes of the liber of the *Bauhinia parviflora* and *Butea superba*. They are conducted by persons of the bearer caste, and usually take six or eight days to reach their destination to Madhapore from Eeroo, although sometimes the voyage is accomplished in a couple of days. The timbers are there classed according to their size:—

1st.—The Mowhoont, twenty-four to thirty feet in a length, with breadth and depth of eighteen inches. A log like this requires a bandy (hackery) with from six to eight bullocks for its conveyance.

2nd.—Doolkahoont. This also is a large timber; but shorter than the preceding, and not so thick.

3rd.—Danpet. Common wood for beams and deals.

4th.—Sarmundum. A smaller timber than the last, used for the same purposes.

All other kinds are classed under *Dunta* for the larger, and *Kurry* for the smaller. The carts for conveying the wood are strong and well built; their axle trees are of the wood of the *Conocarpus latifolia*, and the wheels solid and without spokes of the *Pentaptera tomentosa*. Considering the variety of soils they have to traverse before reaching their destination, they are well adapted for their object; they take fifty days to reach Hyderabad, and it was stated to me, on what I consider tolerable authority, that the price for conveying sixty square feet of teak from Madhapore to Hyderabad, was not much under five rupees! From eight hundred to a thousand carts are annually despatched with teak from Madhapore: the Brinjarries convey the smaller kinds.

Report on the River Indus, (Sections 1 to 5.) By Lieut.
Wood, Bombay Marine.

I.—*A General View of the Indus.*

This report is confined to the navigable Indus, or that portion of the river lying between the Sea and Attock.

Throughout the whole of this distance, the river is known as the Sinde, sometimes indeed it is called the Attock, but this latter designation is local in its application. I have retained both, and apportioned them as follows :—

The Lower Sinde, or Indus, extends from the Sea to Bukkur.

Upper Sinde, or Indus, extends from Bukkur to Kalabagh.

Attock from Kalabagh to Attock.

By dividing the river into these sections, each is made to mark certain important alterations in the navigable character of the stream.

It may here be premised, that of the course of the river North of Attock, our knowledge is confessedly superficial. A few miles above that fortress the Indus ceases to be navigable ; but not before it has received in the Cabool river a tributary, that further extends the advantage of water carriage to the West,—the most important of all directions.

Source.—To what Lieutenants Burns and Macartney have written on the subject I have nothing to add, unless Moorcroft's travels settle the question. The source of the Indus is still a problem to be solved.

In the plain above Attock, the Indus is divided into many branches, but abreast of that fort they all unite. One deep, narrow, clear, blue stream, shoots rapidly past, and at once entering the hills, disappears from sight. Among hilly groups it winds to Kalabagh. At Mukkud the channel widens, and the expanded river flows quietly forwards with a lessened velocity, and a reduced depth. On escaping from its rocky bed the river enters a level country, through which it winds onward to the sea. Its boundaries are now those of the valley ; the Soliman mountains are on one side, and the Indian desert on the other.

Length of Course.—From the Sea to Attock, the distance in a straight line is 648 miles.

By the River it is increased to 942 miles.

Breadth of the Stream.—The width of the surface water in the dry season, varies from 480 to 1600 yards; the usual width is about 680 yards.

Depth.—When the river is in full freshes twenty-four feet; but in an opposite season of the year, nine, twelve, thirteen, and fifteen feet are the usual maxima of its soundings. The greatest depth of water in the Indus occurs between Kalabagh and Attock; one hundred and eighty-six feet has been here sounded.

Velocity.—Seven knots an hour in the freshes, and three when the river is low. It is scarcely necessary to remark, that the three last items are very inconstant. At no two places are the measurements exactly alike, nor do they continue the same at one place for a single week. A more particular account of these will be found under the next head.

Fall per mile.—From Attock to Kalabagh, 20 inches.

Ditto Kalabagh to Mittun, 8 ditto.

Ditto Mittun to Sea,* 6 ditto.

Discharge per second.—Cubic feet Maximum—

in August, 446,080

Maximum in December, 40,857

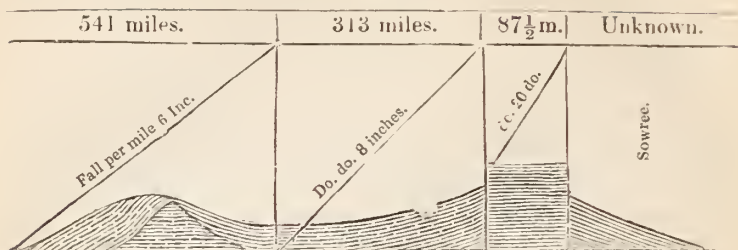
Annual Discharge.—5,383,600,934,400—or 150,212,079,642 tons avoirdupois.

Power of Transport.—Rolled pebbles do not occur in the bed of the Indus below Chandia-ke-kote, a village five miles South of Kalabagh. Above Kote, though not below it, the sand of the Indus is searched for gold. The precious mineral is also found at Dera Ismail Khan; but not in the river.

It is washed down by the rains from the Soliman mountains. Pebbles also occur at a certain spot in the river below Hyderabad, in Lower Sinde; but they can be traced to hills in the neighbourhood.

Height of the River's Banks.—Assuming for the purpose of explanation that the source and the embouchure of the Indus are upon the same level, the river in its long course may be said to have two maxima of rise. These are shewn in the following sketch, where the measurements are those of the stream when in full flood.

* The fall of the river from Mittun to the Sea is from Captain Burnes' Memoir of the Indus.

Distance by the River.

The rise between Kalabagh and Attock cannot be called natural ; it is caused by the contracted bed, into which the stream is here thrown among the mountains. The rise at Hyderabad is the result of a carefully kept register daily ; but at the other places, this item has been reduced from an examination of the river's banks, and the best information I could procure.

Colour and Temperature.—To Dera Ismail Khan, the water of the Indus is of a lead colour ; below that town it becomes of a dirty whitish yellow, tinged with red. In the freshes the red tint is heightened ; but the general colour continues the same.

Between Attock and Mittun, all the streamlets that fall into the Indus are of a bright red ; save the Hurroo and Toe, which have pebbly beds and clear water.

Temperature of the River.

Months.	Air.	River.	Remarks.
February,	69° 2'	64° 2'	Noon observations in the parallel of 24° 0' North.
March,	90° 0'	78° 0'	
April,	97° 0'	81° 0'	
May,	100° 0'	84° 0'	
June,	101° 0'	87° 0'	
July,	95° 5'	88° 0'	
August,	95° 7'	88° 0'	
September,	94° 5'	86° 0'	

II.—Navigable character of the Indus.

Between the Sea and Attock the facilities for navigation are not everywhere equally great. They vary with the state of the river's bed. As an acquaintance with the one may contribute to a know-

ledge of the other, I shall apportion the river into sections corresponding to its capabilities, and afterwards indicate the character of the present method of navigating the stream.

The Delta.—As high as the influence of the tide extends, there will always be an ample depth of water for even vessels of a greater draft than those elsewhere described as the best and only boats suited to the river under all circumstances.

It reaches to Nooroo-kanand, a village on the left bank of the river below Tatta. But above this navigation is intricate, nor does it materially improve till beyond the *Delta*.

This is owing to the great expansion of the river's bed, where among the numerous channels that present themselves, it is not always an easy matter to select the right one. No great inconvenience is felt on this score by the vessels now upon the river, for whether they ascend it laden, or in ballast, dragged by the track rope, or propelled by the breeze, their progress is so slow that they may be said to feel every inch of the way.*

From the Delta to Sehewan.—This is the best portion of the river, and the *Pulla* fisherman as he floats down the centre of the stream, proclaims the fact. The pole to the lower extremity of which his net is fastened, measures from sixteen to twenty-two feet, and according as this may be in March or August, either eight or fifteen feet of its entire length is immersed in water. Two rocky ledges occur in this section; both project from the right bank of this river, and are found, one under the village of Jeskh, and the other at the north end of the Hilaya reach. Both are under water in the swell.

Sehewan to Roree, or Bukkur.—As the character of the last section was determined by the avocations of the fisherman, so may be that of this one. The fishing pole is no longer in general use; but among the shallows in the middle of the stream, men armed with creels, shaped like inverted cones, may be seen busy at work ensnaring the *pulla* fish. Here then it may be presumed, the depths are too irregular for the employment of the former method. Such is the cause, and thus does the practice of the fisheries on this river become an index to the state of its navigation.

Bukkur to Mittun.—A great change here takes place in the character of the river. The stream at Roree, though at some places it may

* See Appendix, Table V. for the soundings of this and other sectional divisions.

be found in a single bed, is more often divided into two or more parallel branches, from 400 yards to four miles apart. Where the former is the case, (at Mittun-kote and for some distance below it, for example,) the channels are more mazy and intricate than where its volume, as in the latter instance, is apportioned among a number of branches. These changes in the configuration of the river are met by a corresponding alteration in the build of the boats. A new description of vessel, called a *tohruk*, of a less draft than the *doondah*, is now the common cargo boat. Where the other is retained, its size is reduced. *Doondahs*, it will be afterwards shewn, requiring five feet and half an inch to float them, are in use upon the river below Bukkur; but above that fort, I have not met a single boat of a draft exceeding three feet nine inches.

Mittun to Kalabagh.—The Indus in this section, as high as Dera Ismail Khan, is equally well suited to navigation, though not better than that last described. It also in some degree resembles that section in its parallel branches and broad bed. Between Dera Ismail Khan and Kalabagh, the difficulties of the navigation increase.

Kalabagh to Attock.—The downward voyage may be made throughout the year; but from April to October the passage is hazardous, and rarely attempted. Boats at all seasons may ascend as high as Sharkee, a village on the right bank of the river, a few miles above Mukkud, but between that and Attock the upward navigation is restricted to the winter months, and even then a boat must have a double crew, and be of a build that does not obtain below Kalabagh, called a *dug-gah*. For a description of this vessel see the 7th article in this Report.

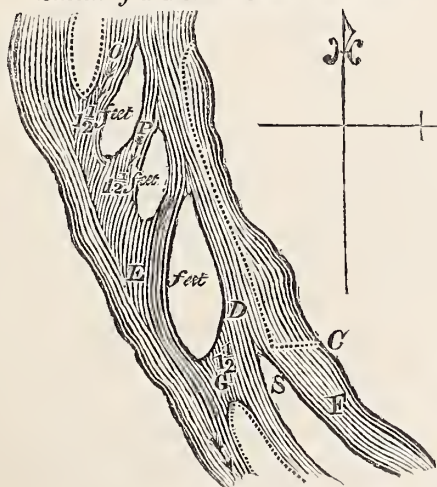
III.—Of the Soundings in Indian Rivers.

After having sketched the greatest capabilities of the Indus from the draft of its boats, it will not be necessary to enlarge in this place on the nature of its soundings. South of Mittun-kote I have inserted, under sectioned heads, specimens enough to shew the characters of the Channels,* referred to. A table marked maximum, minimum, &c. is quite the thing for a thermometrical register; but such a formula for soundings, when applied to an Indian river, mars its own object,

* See Appendix, Table V.

unless indeed it be based on the accumulated experience of years. That I do not therefore crowd these pages with figures, is from a firm conviction of their inutility. They are in fact positively injurious ; for when a practical man at a distance casts his eyes over the contents of a table, purporting to give the soundings in a river's channel, and finds the least depth to be two fathoms, he very naturally concludes that a boat constructed to draw only nine feet, will navigate the said river. No conclusion could be more erroneous, the reasoning is suited to the equable streams of the new world ; but not applicable to the ever-changing channels of our Indian rivers. To what other causes can we attribute that crude digest of a prospectus for introducing steam upon the Indus for commercial purposes, that lately reached this country from England, authenticated by names of the first rank and respectability in the mercantile world ? One of the articles in the proposed Joint Stock Company provided for stationing a ship of one thousand tons, (an old East Indiaman,) as a depôt inside the river. Such a vessel could hardly come in sight of the Sindian coast. Lieutenant Charles' survey of the mouths of the river has made us acquainted with their actual condition, and in another part of this report, what should be the draft of the Indus Steamers ;* and this decision is the result of a most careful examination of the river, both in its dry season and during its freshes.

Sketch of a Reach below Schewan.



* See the 8th Article in this Report.

IV.—Of the mode of Navigating the Indus.

The diagram on the preceding page, represents a reach of the river below Sehwan. The better to illustrate the figure, I shall suppose a boat deeply laden at the village Y is about to start on the downward voyage, and that her "*meerbar*," or man in charge of the boat, is a stranger to the river. Leaving the village, he would doubtless take the large channel indicated by the colored arrows, without regarding, if indeed they had been seen, the numerous offsets on the right hand ; when abreast of the shoal S, a decrease in the depth of water would for the first time apprise him of his having lost the fair channel, and shortly after this intimation had been received, the boat would ground on the bar G. Now by inspecting the sketch, it will be seen that between the villages X and Y, the deep channel has shifted from the left to the right bank of the river. The alteration has been effected by the silent drainage of the lateral channels O, P, E, and D, and by the unperceived departure of a large body of water over the bar extending from S to G into the back water F. E is the passage the boat should have pursued ; but this knowledge could only have been the result of a previous careful examination, appearances at starting being decidedly in favour of channel D. The nature of these changes will be rendered still more evident, by inspecting a section of the river's bed. Take for example the following :—

1st. Channel.

2nd. Channel.

$\overbrace{3.4.4\frac{1}{4}.4\frac{1}{4}.3\frac{1}{2}.2\frac{1}{2}.2.}^{\text{1st. Channel.}}$ $\frac{3}{4}\frac{3}{4}\frac{3}{4}\frac{1}{2}\frac{3}{4}\frac{3}{4}\frac{3}{4}1.1.1.$ $\overbrace{1\frac{1}{2}.1\frac{1}{2}.2.2\frac{1}{2}.2\frac{1}{2}.2\frac{3}{4}.}^{\text{2nd. Channel.}}$ $1.1.1.1.\frac{3}{4}\frac{1}{2}\frac{3}{4}\frac{3}{4}\frac{1}{2}\frac{3}{4}\frac{3}{4}\frac{1}{2}\frac{3}{4}$

3rd. Channel.

$\overbrace{1\frac{1}{4}.1\frac{1}{2}.1\frac{1}{2}.2.2.1\frac{1}{2}.}^{\text{3rd. Channel.}}$ fathoms. Such a line of soundings is not uncommon, though this one differs from the usual section in having an additional channel, two being the more usual number. The junction of these is not effected at a particular spot, but is, on the contrary, the result of a parallel course of many miles, during the whole of which distance the change is gradually being effected. They thus imperceptibly glide into each other ; and should the channel selected by a boat descending the river, be that which the stream is in the act of abandoning, she must be moved into the new formed channel as soon as a decrease of soundings gives warning of the fact. Now it is deserving of remark, that when the necessity of change first becomes apparent,

there is seldom more than three-quarters of a fathom water on the spot separating the channels. Whether alterations in the channels of other large rivers are brought about in a similar manner, I am not aware ; but this peculiarity, if it can be so termed, is familiar to the boatmen on the Indus ; and with a description of the manner of their meeting it, and of the precautionary measures to which it gives rise, I shall conclude this notice of its navigation.

No vessel with cargo on board makes a downward voyage unaided by a pilot boat ; it is called here *sooe*, or guide. These are small cheap skiffs managed by a couple of men, one of whom standing on a platform in the bows gives the depth of water, while the other, with his scull over the stern, steers the boat. Cheap as the services of a pilot may be had, the protracted length of the voyage makes it a burden too weighty for a single cargo to bear, and the custom therefore is, for boats to drop down the river in fleets, or by divisions, when *sooes* become so multiplied, that to every two or three large boats a tender is attached. Grain being the only freight, all shipments are made at a stated season of the year ; and as the quantity of corn produced on the banks of the Indus in autumn far exceeds that cut down in spring, the winter fleet outnumbers in an equal proportion that which takes its departure about midsummer. In February 1837, when the river was at its lowest level, I counted forty-two grain laden boats pass Sehewan on their way to Hyderabad, whither the surplus of the Upper Provinces is yearly exported.

The largest of these boats drew five feet and half an inch of water, and the manner of conducting the fleet was as follows:—When the day's stage has been fixed, a detachment of *sooe* went ahead to sound, into each boat there being, besides her own small complement, two or more of the *doondah's* men. On their arrival all is bustle and noise in the fleet. The fastenings of the boats are cast off, the oars are plied, and the huge hulk, preceded by her guide, shears out into the stream.

If the *meerbars* have confidence in the channels, and the wind be fair, a large square sail is set, and the unwieldy *doondah*, deep though she be, outstrips her tender, and seems to skim the surface of the water ;—such a fleet in motion is worth seeing. First, the large white sail of the headmost boat is discovered at the top of the reach, then another,

and another, until the surface of the river becomes studded with those uncouth, yet really interesting objects. As may be supposed, this mode of navigation is tedious, the daily stages not averaging more than from ten to twenty miles. Delays too are not unfrequent in the dry season; but never exceed fifteen days, and rarely extend to half that number.

When there is a prospect of a long detention, it is customary for large boats to transfer a portion of their cargo into smaller ones, and take it on board again when the shoal water is past. In high wind, the boats remain fast by the bank of the river. The two following Tables are inserted in illustration of the above remarks :—

Tables, shewing the cargo draft of the largest boats upon the Indus, with the least water in the continuous channel, during the dry season of 1837.

Draft of Boats.

Channel.

Class of Boats.	Cubic Draft.		Gunwale above water line.	Places.	Depth.	
	Ft.	In.			Ft.	In.
1st Class,	5	0 $\frac{1}{2}$	10 Inches.	Gooloo,	3	8
2nd ditto, ..	4	9	9 ditto.	Lillong, ..	4	4
3rd ditto,	4	3	9 ditto.	Mycotta, ..	4	8
4th ditto,	3	3	7 ditto.	Bulalpoor, .	4	1
5th ditto,	3	0	5 $\frac{1}{2}$ ditto.	Kaira,	4	8

The places in the above Table are all situated between Sehewan and Rorec; but they furnish a good example of the depth in other places.

Boats descending in the freshes, proceed as above described. In this season the length of the voyage is much shortened, though attended with considerably more risk. A pilot is still required; but a previous examination of the channel is not always considered necessary.

The following Table gives a statement of the downward voyage at opposite seasons of the year. It embraces the whole navigable extent of the river, and includes Pilotage where such a custom prevails. The voyages are such as are rarely performed even by Sinde boats, even when the river is clear, and other circumstances favourable.

The Downward Voyage.

Stages.	Dry Season.	Freshes.	Pilotage.
Attock to Kalabagh,	1½ Days	1 Days	—
Kalabagh to Dera Ismail Khan,	7 ditto.	2 do.	6 Rupees
Dera Ismail Khan to Dera Ghazee Khan,	10 ditto.	3½ do.	6 do.
Dera Ghazee Khan to Mittun,	4 ditto.	2 do.	3 do.
Mittun to Roree,	6 ditto.	3½ do.	a boat 18 Rs.
Roree to Sehewan,	7 ditto.	4 do.	do. 16 do.
Sehewan to Hyderabad, ..	3 ditto.	2 do.	do. 12 do.
Hyderabad to Sea,	2½ ditto.	2 do.	do. 12 do.
Total	41 Days.	20 Days.	

The upward voyage is performed by the aid of the wind and track rope. This last mode of procedure is slow, but certain; and averages about eight koss, or thirteen miles, a day. With a strong favourable breeze, the daily progress is increased to twelve and eighteen koss. The prevailing winds during the year, and their consequent influence on the navigation of the river, are given under the next head, and it will there be seen that the freshes, far from presenting any obstacle to the upward voyage, are more favourable to it than otherwise. During their continuance, a south wind blows from the sea to Kalabagh; and though less steady on the Upper Indus than in the lower part of the river, it is a great service to navigation, since the time consumed by an up-river voyage, in the dry season, may be stated as one-half in excess of that required to perform it in the swell. Annexed is a Table, shewing the relative time occupied by the voyage at opposite seasons of the year:—

The Upward Voyage.

Stages.	Dry Season.	Freshes.
Seaport to Hyderabad,	15 Days.	7 Days.
Hyderabad to Sehewan,	8 ditto.	4 ditto.
Sehewan to Roree,	14 ditto.	7 ditto.
Roree to Mittun,	14 ditto.	6½ ditto.
Mittun to Dera Ghazee Khan, ..	10 ditto.	4 ditto.
Dera Ghazee Khan to Dera Ismail Khan,	11 ditto.	10 ditto.
Dera Ismail Khan to Kalabagh, ..	12 ditto.	7 ditto.
Kalabagh to Attock,	15 ditto.	Impracticable.
Total, ..	107 Days.	45½ Days.

Of the foregoing Tables it may be remarked, that under a different management, the number of days occupied in performing the voyages, especially up-river in the dry season, will be much reduced. At present, *time* is no object to the Sindian; and besides, he loads his boats so deep, that the ripple caused by only a moderate breeze, endangers her safety.

V.—Of the Winds and Weather in the Valley of the Indus.

The prevailing winds of the Indus conform to the direction of the river, blowing for six months up the stream, and as many down it. From April to September the breeze is southerly, and during the other months of the year it comes from the north. An east wind of twelve hours' continuance is rarely felt. When a change in the prevailing direction takes place, the wind veers by the west from 10 p. m. till noon of the following day; the wind is usually fresh. The evening and afternoon too often oppressive, for want of the usual breeze. This last remark is, however, more especially applicable to the weather on the Upper Indus.

In Lower Sindh it is often just the reverse, the breeze there freshening up about 3 p. m. However warm the day may have been, the nights, with few exceptions, are cool. A more particular account of the prevailing winds will be found in the annexed Table:—

Prevailing Winds.

Months.	North.	South.	Calm and Variable.
January,	29	2	0
February,	22	6	0
March,	17	13	0
April,	7	15	8
May,	1	29	1
June,	0	28	2
July,	0	28	3
August,	6	27	4
September,	0	24	0
October,			
November,			
December,			

The south wind.—It reaches Kalabagh at the entrance of the mountains, and last year was as fresh and steady upon the Upper as on the Lower Indus. This wind is believed by the boatmen of the latter to cease at Sehewan, and in my report on the inundation in 1836 I mentioned the circumstance. Such, however, is not exactly the case. South of Sehewan a spur from the Hala mountains comes down upon the Indus, which intercepts the breeze, and turns it off from the river, so that above the town for many miles calms and sultry weather are characteristic of a season remarkable at other places for the steadiness of the prevailing wind; yet though this peculiarity is thus shown to be local, another circumstance leads me to think, (contrary to my own experience,) that the south wind is less fresh upon the Upper Indus than lower down the river. Above Roree the boats have but a single reef band in their sails, while at Hyderabad it is no uncommon thing to see them scudding before the breeze with their sails double and even triple reefed.

The north wind is not so steady as the south, but is oftener more violent while it lasts; clouds of sand darken the air, and compel the trackers to bring their boat to the bank. This wind is cold in November, December, January, and February; the thermometer at sunrise is often but a few degrees above the freezing point. During the season that northerly winds prevail, gales from the south are not infrequent. These are always scarce, and usually, last three days. The change is marked by cloudy, rainy weather, lightning, and thunder.

Variable Winds.—During those sultry breezes that follow the daily lulling of the prevailing wind, the calm is often agreeably broken by light breezes off the river.

These are seldom sufficiently strong or lasting to benefit navigation, but in tempering the heat of the atmosphere, and conducing to the health of the numerous tribes that dwell on the banks of this river, they serve an important purpose.

Storms.—Plenty of warning is always given, and ample time afforded to secure the boat, which should be done either under the weather bank of the river, or the lee side of an island or sand bank. An unsheltered position in deep water, with the open river to windward, generally settles the fate of an Indus boat. If loaded, she

at once fills and goes down, and if empty, the shaking produced by a short chopping sea soon opens the seams of a vessel that has no beams to hold her frame together.

In a river danger from this cause may appear slight; but when the stream and wind are opposed to each other, a short breaking sea is formed, that will swamp a six-oared cutter at a grappling. Most of the boats that are lost on the Indus, are wrecked in the manner here described. Gales of wind are experienced throughout the whole line of the Indus. They are more frequent near the mountains, than in the neighbourhood of the sea.

VI.—Of the Boats upon the Indus.

The boats upon the Indus are of simple construction, and their figure is perhaps the best that could be given, considering the kind of navigation in which they are employed. They are easily constructed, not very expensive, and for stowage of cargo, no form could be better devised. Their proportions though not elegant, are pleasing, and tracking or under sail, their appearance is pretty.

The employment of the Indus craft is confined to harvesting the crop, serving the ferries, and keeping large towns in fuel. For these purposes, the supply is ample. Second, between the sea and Attock two kinds of vessels are in use, the *zohruk* on the Upper, and the *doondah* upon the Lower Indus. In boats belonging to the latter class, a slight difference in the build gives rise to a further classification, and of this description of vessel the *moohanah*, (boatman,) enumerates more than one variety. But before particularizing each, a description of the *doondah* is necessary. Her good and bad qualities are shared alike by them all, and the following notice of this boat is therefore applicable to every vessel on the river :—

Form and method of construction.—The hull or body of the boat is formed by the junction of three detached pieces, namely, two sides and a bottom—at variance with our ideas of naval architecture; the three parts are first separately completed, and then brought together as a cabinet-maker does the side of a box. The junction is thus effected: when each of the three parts that are to form the whole is completed in itself, the sides are carried to the bottom of the boat, and at

once secured by crooked pieces of timber to the flat future bottom of the *doondah*. To bring the bow and stern up to the corresponding parts of the side is more difficult; and to effect this, many days are necessary. Where the bow and the stern are to rise, the planks are lubricated with a certain composition, which gives them a tendency to curve upwards, and this is further increased by the application of force. The extremes thus risen, a tackle is stretched between them, and by constant application of the heating mixture, and a daily pull upon the purchase, they rise to the required angle, and are secured to the side, while an advantageous curve is imparted by this process to the plank in the boat's bottom. The bow of the *doondah* is a broad inclined plane, making an angle of about 20° with the surface of the water. The stern is of the same figure, but subtends double the angle.

Advantages of this construction.—To the slight curve in her bottom planks she is indebted for the following advantages:—In descending a river, should she strike upon a sand bank the boat turns like a top, and presents no stationary point for the stream to act against. A merely flat-bottomed vessel would probably shew her broadside, and the stronger the current was running, the greater would be the difficulty in getting such a boat again into deep water. Thus in a situation where the *doondah* experiences but a little inconvenience, and occasionally it may be a few hours' detention, a boat of another and but a slightly altered form would be very awkwardly placed, though her safety might not be actually endangered. In passing through eddies, the common or wedged-shaped bow dips considerably, while the form of the *doondah's* prow has a tendency to lighten her draft, and the more rapid the current or the greater her velocity, the more buoyant she floats. When forced out or against the river's banks—an accident which the defective steerage of the *doondah* renders of frequent occurrence in tracking—the form of her bow, where the bank is not too high, parries the violence of the shock. A greater defect in the common wedged-shaped bow for river navigation, (at least in those of the Indus, where the current is very irregular,) is the surface it presents for currents or cross-currents to act against; these force the boat from its course, and deprive the helm of its power. In tracking this is often seen; and I can remember rather a ludicrous instance which occurred to the *Indus Steamer*,

whilst coming up the river to Hyderabad in 1836. The day to which I allude, it was necessary to second the power of the engine by a tracking party on shore, and a number of Hindoo countrymen were employed for the purpose. All went on well, till the bow of the boat got inclined to the direction of the current, when out she shot like an arrow into the stream, and with her dragged the trackers.

Casting off the drag rope prevented accident; but the situation in which it left the Hindoos, was not a little grotesque. Between the firm ground and the river lay a strip of recently placed alluvium, and in this the Sindecs were planted at various depths, from the middle downwards.

The present great defect in the form of the *doondah* is bad steerage. By rounding her quarter, and making other judicious alterations, this could be improved. To fit them for conveying merchandize, they require to be stronger built; and for the convenience of the merchant, to have better accommodation; in fact to be restored to the state in which an early traveller, Captain Hamilton, described them when trade flourished by the Indus, and its arrangements were such as to attract the notice of an intelligent European.

Rig of the Boats.—The masts are poised upon strong beams resting athwart the gunwales. Moving on this *fulcrum* their management is easy, and the masts can be lowered down or placed upright at pleasure.

The sail is hoisted behind in preference to before the mast for several reasons, the principal of which is, that as the boat sails only with a favourable wind, it is never necessary to brace or haul up the yard, and fewer hands suffice to manage the boat.

The *jumptee* is the state barge of the Sinc Ameers, and is used by them and their principal officers on all occasions, whether of business or pleasure. Perhaps the appearance of this boat, as she approaches the capital, is more characteristic of the Indus and of Sinc, than aught else to be seen in the country. On this day her *meerbar* puts on clean clothes, and the national cap received from the Ameers on a recent river excursion. The bright hues of the cap, formed by the gaudiest coloured chintz, vie with those of a Kilmarnock bonnet, or a Paisley tartan. The crew are dressed becoming the occasion, and as they bend to the track rope, the breeze

distends their ample robes, and a further character of stateliness is imparted to the *jumptee*. Large red flags were over her stern, and from the raking mast streams a long party-colored pendant that anon skims the water, as the breeze lulls and freshens. In the bow of the boat is a small crimson pavillion, in which royalty reclines, and in the other extreme of the vessel, a roomy cabin of elaborately carved work, for its numerous attendants.

The steersman on an elevated platform, stands in bold relief, and while he guides the boat, encourages the trackers. The *jumptee's* crew are a noisy set; but for aged men, wonderfully good humoured. They are divided into two gangs or watches, and are as partial to a cup of good *bang*, as sailors are to grog. These boats are decked, and of considerable tonnage. One which I saw at Hyderabad, measured one hundred and twenty feet over all, with a beam of $18\frac{1}{2}$ feet; her draft of water was two feet six inches, she pulled six* oars, and had a crew of thirty men. They are built of Malabar teak, chiefly at the ports of Mughribee and Curatchee. *Jumptees* are seldom lost; the only danger to which they are liable is that of having their bottom pierced by sunken trees. Their more substantial build keeps the frame of the boat together in situations where the poor-pieced shell of a *doondah* would fall asunder. The *doondah* is the cargo boat of Sinde; her principal and almost her sole employment being, the transport of grain.

The Cowtell.—This again is the ferry boat of Sinde; her construction adapts her for this service, and for conveying houses up and down the river. From her great beam and high draft of water, she is a faster boat than the *doondah*. In all their excursions on the river, the Ameers are accompanied by many boats of this description. The class is not numerous, and most of the boats are the property of government.

The *doondie* is common from the sea to Mittun, and the boat most generally used in the fisheries, both upon the river and its *dunds*, (small lakes). It is the smallest description of vessel upon the Indus, and at the same time one of the most useful. Two men are ample to its management; but a man and wife are its usual crew.

The Zohruk.—What the *doondah* is in Sinde, the *zohruk* is upon the Upper Indus, namely, the common cargo boat of the country. The

* So in MS. ? 16 oars?

planks of this vessel are held together by clamps instead of nails, and the junction is often neatly enough executed. This class of boats is not so strong as the *doondah*, but they sail faster and draw less water. They are more roomy than the *doondah*, and though less adapted for the conveyance of goods, are much superior for transporting troops.

The Duggah.—This is the clumsiest, and at the same time, the strongest built boat upon the Indus. She is confined to that rocky and dangerous part of the coast, between Kalabagh and Attock. The form of the boat differs but slightly from that of the *doondah*. The *duggah* has neither mast nor sail. Her name is the Sindean word for cow, and the awkward sluggish motion of this boat shews that it has not been misapplied. If the *duggah* drops down the river to Mittun, there she must remain, and be sold for whatever sum she will bring; for to drag her up against the stream to Kalabagh, would cost more money in the hire of men, than the boat is worth.

Management of the Boats.—Under sail the very best of them will not be within eight or nine points of the wind. Dropping down the river with a contrary wind, the mast is unshipped, as also the rudder, and the latter is replaced by two sculls. Should the wind blow strong, a boat without cargo can make no progress, and the safety of one laden, is endangered by the chopping sea it raises.

Tracking is performed as follows:—the boat is provided with a track rope at least a hundred fathoms long; it is rove through the uppermost sheave-hole at the mast head, and the inner end fastened to the rail or platform on which the steersman is standing. On the hauling post before the mast, is a guy, called a "*lagh*," the lower end of which passes through a ring bolt in the bow of the boat. This guy is of as much utility as the helm itself. Before the boat starts the track rope is middled, and the inner half coiled down under the feet of the steersman: one man is stationed by the guy, and the remainder of the crew toggle on to the shore part of the line. Thus yoked they march at the rate of two miles an hour up to the knees, often higher, in water or in mud. Whilst thus advancing the foremost walker calls out "*shoal water*," on which the inner end of the clog rope is let go, the guy eased off, the helm put to one side or the other, as the case may be, and the boat thus relieved, avoids taking the ground by shooting out into the stream. The shoal passed, the guy

is shortened, the line again middled, and the crew advance at the same slow pace as before. Boats should have two track ropes, and when turning the bends of the reaches, both should be on shore. They should also be provided with a heavy grapnel to drop, in the event of accident to the track ropes.

The steep banks in bends of the river should be avoided, for under it circles a current in a contrary direction to that of the main stream, the quick gyratory motion of which is constantly exerted to the destruction of the bank, and that of such boats as frequent it.*

Boat Building, Materials, Suggestions.—Boats are constructed according to established usage, which has fixed a proportion between the beam and length of each boat. The tonnage is calculated on the boat's bottom, from the point where the stem and stern rise. The angle at which it takes place is matter of taste, a high projecting stern improves the steerage, and a low bow gives speed. The banks of the *Indus* are deficient in almost every article used in constructing the boats on the river. The Lower Sinde is supplied with plank and spars from the Malabar coast, and with coir and cordage from the same quarter. The Ameers of Hyderabad, are, however, the chief, almost the sole purchasers. The *Moohana*, unable to give the high price asked by Cutch boatmen for teak plank, exhibit both skill and ingenuity in building boats of timber of their own country's growth; for this the orchard is robbed, and the country for miles round laid under contribution. In the bottom of a single boat, teak, baire, fir, babool, and the curreet tree are sometimes seen together, and in the same extent of workmanship, six hundred and seventy three patches have been counted.

The Upper *Indus* is principally supplied from the banks of the Chenaub, where the talee tree, the sissoo of Hindostan, is seen with a trunk measuring twelve feet in circumference. Three such trees furnish plank enough to build a large sized *zohruk*.

The Attock boats are built of good fir, brought down the Cabool river, and from the forest of the Lower Himalaya.

Iron Work.—The Lower Indus is supplied from Bombay, and the upper portion of the river from the mines of Bunnoo and Badjour.

* See an example of this in Table VI. of the Appendix, headed Irregularities in the bed of the *Indus*.

It is customary to purchase the latter in the matrix, and to allow a per centage to the blacksmith who smelts the ore, and works it up into nails.

Cordage.—Upon the Upper Indus the rope is either of hemp, or formed from the culm of certain tall reedy grasses, very plentiful on the banks of this river.

The tools of the Sinde carpenter are as little diversified in form as those used by the same class of artificers in India. The absence of good material to work upon sharpens his inventive powers, and gives a manual dexterity that improves the execution of whatever he may have to do, when really good timber comes before him. If a curve is to be imparted to one or a dozen planks united, chaff moistened with water is the Sinde carpenter's store ; or what answers the purpose still better, the dung of animals, and more especially that of sheep.

Teak-built boats are much prized by the *Moohana*, as are those of cedar and fir construction, which come from Pind Dadun Khan, on the Jalum. Such boats, when well put together, will run forty years ; but from seven to ten is the duration of those patched up with the jungle wood of the country ; and if care has not been used to see that the wood employed in her construction was originally well seasoned and selected, a less number of years brings on the decrepitude of age, when to delay a thorough repair, is to lose the boat.

Adaption of the Indus Boats, for the transport of military stores.—They are not calculated to bear the weight of ordnance, such as a battering train ; and at the present moment there is not a boat upon the river, which a Committee would declare efficient for the transport of these heavy guns. For this purpose, the boat should have a perfectly flat bottom, that the weight of metal may be equally distributed over the immersed portion of the hull. The sides too require to be fixed to the bottom in a more secure manner than is at present customary. The knees which connect them should be formed of iron, in preference to wood. If shot is to be carried, the bottom of the boat should be planked over the beams, as well as under them. The latter is all that is done at present ; but if this is not guarded against, the nails will draw, and the shot fall through.

Should it become desirable to increase the amount of tonnage upon the *Indus*, boats could be built at Bombay, Hyderabad in Sinde, or

Pind Dadun Khan in the Punjab. If at the former place, it would be desirable there only to prepare the frame; but to build the boat, that is, to put her together in the river, good artificers are to be had in the country; but the introduction of a few superior workmen from the dockyard, with a clever native foreman or overseer would be necessary. A smith is an indispensable accompaniment, and when steamers are introduced, this establishment should, to be efficient, be possessed of science, material, and skill. If Hyderabad were to be selected for building boats, still all the material must come from Bombay. If Pind Dadun Khan had the preference, a small supply of cedar plank might be there calculated upon, and the services of better workmen than are to be procured in Sinde.

Boat Hire.—In this charge there is some incongruity; yet it does not appear to exceed the rate of hire that prevails upon the Ganges.*

VII.—Of Steam Vessels for the Indus.

Naturally solicitous to be acquainted with the present state of internal steam navigation upon the Ganges, on presenting Government with the result of my experience on this river, I addressed a letter, forwarding a list of queries on the subject, to Mr. C. B. Greenlaw of Calcutta, and through the kindness of that gentleman, I have been favoured with the accompanying valuable report from the pen of Captain Johnston, controller of Government steam vessels,—an officer more conversant with these matters than any man in India. In submitting this document to his Lordship the Governor General in Council, I will only remark, that in every essential point the class of vessels described by Captain Johnston, seems well suited to the Indus, and the economy that pervades the steam establishment upon the Ganges, is worthy of imitation here.

Towards the close of the year 1835, when the *Indus* steamer arrived off Hyderabad, one of the Sinde Ameers expressed a wish to be possessed of a similar, but a more powerful vessel. Captain Burnes, who was then at that court, requested my opinion on the description of vessel best suited

* See Appendix, Tables IV, VII, VIII, for the tonnage, price, and hire of Indus boats.

for the Indus, and from the reply to his communication, the following paragraph is an extract, from which it will be observed, that I had then fixed for the draft of an Indus steamer, the exact number of inches, which boats upon the Ganges draw.

Paragraph 11th.—"In a preceding paragraph, I stated that powerful vessels were required on the Indus; the reason is this: In some parts of the stream, the current has a velocity of five and six knots an hour.* It will, therefore, be wise to possess a sufficient power, since steam is now so under controul, that in the downward voyage, where accidents are more liable to occur, it can be reduced at pleasure; but if the engines be originally too weak, a new boat is a costly remedy. Two feet six inches is a good draft of water, and ought not to be exceeded, the boat to have great beam, not much length, and no keel."

Remarks on the Steam Boats of the Ganges, furnished by their Controller, Lieut. Johnston, R. N.

"Four iron steam boats are now employed in inland communication; each steam boat is 125 feet long over all, 22 feet broad, and tows an accommodation boat of the same length, and 20 feet broad, with a hold of five feet deep, capable of towing 4000 feet of cargo, weighing 40 tons, the boat's draft when so loaded, not exceeding 30 inches. The iron sides of the boat are 5 feet deep, above that is a light superstruction of wood in the accommodation boat; between the deck, which forms the hold and the deck on which the crew and passengers walk, the height is nearly 7 feet, and the included space from one end of the vessel to within 20 of the other, or fore end, is divided into cabins and dining rooms, &c. Fourteen cabins are available to passengers; four of 12 feet by 9; four of 9 by $8\frac{1}{2}$; and six of $8\frac{1}{2}$ by $6\frac{1}{4}$; a dining room 20 by 12; two bathing rooms; two pantry or store-rooms, a butler's room; guard room, and two cabins for officers. Each cabin has a water closet; the windows or venetians are 4 feet deep by $2\frac{1}{2}$ wide. In the steam boat, the iron side is continued up in the centre to the height of the beams, which carry the paddle shafts, and the light paddle boxes

* I had not, when this was written, seen the Indus during its freshes.

are of wood. The engines are double, of 60 horse power, oscillating; they consume of Burdwan coal about 10 pounds per horse power per hour, and carry at a draft of 30 inches, about 450 maunds. In the steamer there is a large cabin abaft the boiler, not habitable by Europeans in the warm weather; but very comfortable in the cold. Before the engines, there are two cabins on each side, 8 feet by 5, with a space between that forms a mess room. There is also a very light cabin on the deck of $\frac{3}{4}$ inch board 8 feet by 10; the engines are before the boiler; the steamers have one mast and top-mast, on which they set square sails when the wind is fair. The boat, (a good stout cutter,) is always towed close up to the stern of the accommodation boat. The anchors are 4 and 5 cwt., besides stream and kedge anchors, grappels, &c. They are well furnished with ground tackle; chain cables are alone used. The diameter of the paddle wheel is 16 feet, the breadth 6, the board 6 feet long, 8 inches deep, and 18 on each wheel: they are preferred of fir, and are 2 inches thick. The centre board, when the vessel has her coal on board, is 3 inches below the water surface. The greatest speed of the steamer when alone, is 9 statute miles an hour; with the accommodation boat in tow, 7 miles.

“The contractors have their coal in dépôts on shore, and send it in boats to the steamers when they cannot lay along-side the bank. Coal is taken by weight, and one hour allowed for the delivery of one hundred maunds.

“In the bow of the accommodation boat and in the stern of the steamer, are fixed strong posts well secured, and at the same height a saddle is bolted on each, and protected by an iron plate. An iron hoop 6 inches deep is on the post also above the saddle, in contact with it; a beam of 18 feet long, 14 inches broad, and 5 inches thick, with jaws at each end, connects the boats by resting with its two ends on the saddles, and is secured round the posts with a chain with a hook and lever, so as by letting go the end of the lever, to detach the chain in an instant, and allow the boats to separate. There are also hawsers from each bow of the accommodation boat to the paddle boxes of the steamer, which serve to guide the boats, and assist the steering; the following boat acting as a powerful rudder to the preceding one.

“Progress is more easy and safe up the Ganges during the dry season. There is little danger at any time in ascending the streams, but much in coming down; most during the dry season, when the channels are all defined, and the commanders are instructed to come with great caution, dropping through the difficult reaches with the head of the boats up the stream. They are instructed to consider the preservation of the boats the first consideration; speed a secondary one. In the dry season, the voyage downwards frequently occupies sixteen or seventeen days; in the swell five, six, seven, and ten; the upward voyage during the greatest strength of the current occupies from twenty-five to thirty days; at other times nineteen to twenty-three, and twenty-five in the swell. The current of the Ganges is seven miles in the dry season.

“The boats in the swell can generally evade the strength of the current by running over, or on the edge of sands; in the dry season they must generally encounter it in full force.

“There is an establishment of Pilots, (native fishermen.) The distances vary from eighteen to twenty-six miles, through which they are required to be acquainted with the channels; nevertheless, a boat seldom makes a voyage without grounding, and the principal injury the boats sustain, is coming in contact; under these circumstances, it is nearly confined to the superstructure. On one occasion only a pair of boats suffered under water, being thrown against rocks by a strong eddy when descending under steam; each boat had a hole forced through the bottom; they were easily stopped, the injury being confined to the portion of metal actually in contact with the rock. A wooden boat would have been shattered by the concussion.

“It would not be possible to construct wooden boats to retain their form as the light draft the iron boats do; and I can conceive no means of improving on the boats we have, limited, as by the nature of the rivers we are, to length and draft of water. I believe, that for the Ganges above Allahabad it will be in my power to fix a steam boat not to draw more than 22 inches, with 24 hours' fuel, the economy of weight will be confined to the superstructure, the iron hull being the same in point of form and dimensions as those now plying, the metal a little higher.”

(Signed) JAMES H. JOHNSTON.

There is one point in the above report, where I conceive a different arrangement must be made upon the Indus to what prevails on the Ganges. Most of the fuel *depôts* on the Indus must be afloat. If wood firing is used, there is no alternative, for otherwise the time lost taking it on board will cancel all the other advantages of steam.

The banks of the Ganges are high, substantial, and compared to the banks of this river—permanent. Towns overlook the river ghauts, or landing places are constructed on the banks, and the steam boat at most of the stations has only to shore alongside the ghaut and receive her fuel.

It is very different with the Indus. Towns stand within two miles of the river, and the banks are ever varying their outline. I would therefore recommend that large manageable flats be used for this purpose, and anchored at such distances apart as subsequent experience may suggest; their draft should be restricted to 3 feet 6 inches, and each should have a small boat attached, by which means the crew of the flat would be able to keep the floating well supplied from the shore store.

I am further of opinion, that were the *zohauk's* defective steerage overcome, steamers built upon her model will prove efficient boats.

VIII.—Of Fuel for Steam Boats.

The jungle on the banks of the Indus contains the following trees:—

1. *Mangrove*.—Found in the Delta, is plentiful, and burns well. Though it attains no great height, it has sometimes a circumference of 12 feet.

2. *Kundie*.—Rarely exceeds 9 feet in height, and is found, though not confined to the locality under the Lukkee mountains, between Chandkote and Sehewan. In Lower Sind, this wood is scarce; but twelve miles south of Mittun, on the west bank of the river, is an extensive jungle, in which this is the most common tree; the hardness of its fibre and the crookedness of its grain, make it in great request among the boat-builders.

3. *Baun*.—Little of this wood is seen below Hyderabad; but between that capital and Sehewan the tree is common. As a fuel, it is useless.

4. *Jall* or *Pello*.—This tree is found in every part of the river's course. Between the river and Desert, two descriptions of trees prevail. Tama-

risk fringes the river, Jall or Pelloo the desert; the latter as a fuel is not superior to Baun.

5. *Tamarisk*.—From the sea to Kalabagh, this wood is more or less plentiful; almost any quantity of it is procurable; but the large wood is distant from one to twelve miles from the Indus, and considerable expence and delay must necessarily be incurred in transporting it to the river. *Tamarisk* is the common firewood of this country.

6. *Kurreel*.—It is plentiful in Sinde; but makes an indifferent fuel; it gives out volumes of smoke, but emits no flame. This wood is generally crooked, and its fibre being hard, it is advantageously used for knees of boats, and wherever curved lines, strength, and durability are sought to be combined.

7. *Loohera*.—Between lake Munchur and the mountains, grows a tree of this name, of a dwarfish size, and very common; as a fuel it is even worse than the last described.

8. *Tallee*.—This tree is not common on the banks of the Indus, and the few that do occur, are found near villages, in single trees. It attains a large size, and is much in request amongst the boat-builders. It burns well; but the tree is too valuable to be cut down solely for firewood.

9. *Babool* or *Bubber*.—This tree is plentiful in Sinde; but becomes less as we ascend the river. It makes an excellent fuel.

Shikargahs or *Hunting Forests*.—They are numerous below Sehe-wan; but above that town, they are not found. The trees they contain are mostly *Tamarisk* and *Babool*. These forests at some places fringe the river for three and four miles; but their medium width seldom exceeds one. In a few of them are trees of a large size; but far the greater number are merely extensive thickets, containing saplings of sorts, tall grass, and reeds, the spontaneous offspring of a rank inundated soil.

In December 1835, I made several experiments with the *Indus* steamer to ascertain the relative strength of wood and coal fuel. The result was as follows:—*Tamarisk*, when newly cut down, would not generate enough steam to keep the engine, though working only one-half power. If the billets were large and thoroughly dry, it answered the purpose better; though I consider this wood at best but a very indifferent fuel. *Mangrove* and the *Babool* trees are much superior; burning equal proportions of the two last, the furnaces were reple-

nished once in seven minutes : with coal, (not however of a very good quality,) every fifteen. Coal has thus an advantage over wood fuel in something more than the proportion of two to one, and when the superior performance of machinery driven by the former is taken into account, it is doubtful which is the more economical plan to navigate the Indus, with coal from England, or the jungle now growing upon its banks.* The question resolves itself simply into one of expence, for there is wood enough on the banks of the Indus, to keep two or more steamers constantly plying for years to come.

On this subject, Captain Johnston, the Contrôller of Government Steam Vessels, has made several experiments with steam boats on the Ganges. The result is already before Government ; but having obtained, through the kindness of that officer, a copy of his report, the nature and value of its contents is my apology for introducing it here.

*Report on the relative value of Wood and Coal, by Captain Johnston,
the Contrôller of Government Steam Vessels.*

On Friday the 27th instant, I ordered the steam to be got up on board the *Experiment Flat*, and ran for two hours on the ebb tide between Fort William and the Reach below Budgebudge, and consumed nine and half maunds of coal, making on an average 29 revolutions. I then returned with a flood tide, and in two hours consumed $11\frac{1}{4}$ maunds of wood, making on an average 21 revolutions. I also noted the time we were running the same distances under coal and wood steam ; the periods were 90 minutes with coal, and 112 with wood ; great care and persevering attention were required in the stocking with wood to keep the steam up, and twice the engines were nearly at rest from the steam failing. Admitting that the revolutions of the wheel on the strokes of the piston in the cylinder measure the steam expanded in any given time, the coal would have supplied the cylinder 6960 times.

The wood,...	5040
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Making a difference of	1920
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* Coal has been discovered on both banks of the Indus; the locality is the salt range, in the parallel of 32° North, deposits extending in a longitudinal direction ; but not in a North and South one. Ten specimens from the West bank procured by Captain Burnes have been analyzed by Mr. Prinsep, and four of them pronounced to be the purest form of mineral coal. Those forwarded by me, and discovered on the East bank, have not yet been examined.

measures, which at 42 per minute, would have required $45\frac{1}{2}$ minutes longer of the consumption of wood to have completed, which at the rate of $11\frac{1}{4}$ maunds in 240 minutes, would have required $4\frac{1}{4}$ maunds nearly, which added to $11\frac{1}{4}$ would make $15\frac{1}{2}$ maunds of wood to produce the same quantity of steam as $9\frac{1}{2}$ maunds of coal; but it has been seen, that owing to the weakness of the steam provided by the consumption of wood to perform the same distance, required $\frac{22}{120}$, or one-sixth more time nearly, a detention most injurious to the interest of Internal Steam Navigation.

30th October, 1837. (Signed) J. H. JOHNSTON, *Controller.*

IX.—*Of the Inundation.*

Like all other large rivers, the Indus is subject to a periodical increase of its water; during the continuation of which, it inundates a large tract of country. The river rises in March, and falls in September. From Mittun upwards, I have delineated the flooded district upon the chart; but in tracing their boundaries between that district and the sea, I labour under the disadvantage of having to draw my material as much from hearsay as personal observation.

It may in this place be observed, that the valley of the Lower Indus owes its crops entirely to the yearly swell of its river.

The soil of Sind is naturally poor, producing spontaneously the products of the desert; but save within the belt of inundation, neither grain for man or grass for cattle. Even here grass is scanty and coarse; a turf is a thing unknown on the banks of the Indus, and the Islands in the stream below Bukkur are nothing more than naked sand banks. Two consecutive crops exhaust the soil, unless manured. The natives it is true liken it to gold; but the comparison would be more just if applied to the river, the cause of all its fertility. On the banks of the Upper Indus the soil improves, and were such subject not irrelevant to this report, I might proceed to adduce the proof of this assertion, and to investigate the cause of so apparent an anomaly.

In some respects, the annual swelling of the Indus is attended with peculiar phenomena. One year the country on its right bank is so deluged, that towns and villages, though protected by strong dams,

are threatened with inundation; while on the opposite side of the river, there may be found, during the same season, a difficulty of irrigation. In thus distributing its favour, the stream exhibits more of constancy than caprice, for when once it has taken to either of the banks, it adheres for a series of years to the favoured side. Another circumstance merits notice. The Mississippi when in flood, as we learn from Audubon, the talented American ornithologist, inundates the valley to a large extent; at that season the Squatter and a Lumber river canoe pierce the thickest depths of the forest, while flat boats of great burden, and steamers of noble dimensions, are seen moored to stately trees overhanging its banks. The Ganges in the lower part of its course, overflows its banks in a similar manner to the Mississippi. During the S. W., or rainy monsoon, when the former river is in flood, the whole of its Sunderbunds, or Delta lands are, according to Rennel, submerged. With the Indus it is different. Inundation here is more often partial than general, and at the height of its freshes, the Persian wheel may be seen watering fields on the verge of its banks. The *Kurreef* and *Rubbee* (Autumn and Spring) harvest affords the most conclusive evidence in this case. The crops of the first are produced from an irrigated, and those of the latter from an inundated, soil; while the weight of the *Kurreef* harvest is to that of the *Rubbee* nearly as two to one.

On inspecting the accompanying chart of the Upper Indus, it will be seen that the river has double banks, or inner and outer ones. The first of these is as changeable as the navigable channels of the Indus, the latter as permanent as the river's course; the inner banks from its bed in the cold season, when the water is low and permanent, hem in the floods and freshes of an opposite season. The following Table will further illustrate this interesting feature of the Indus, though I believe it is one common to all rivers flowing through plains:—

Outer and inner Banks of the Indus.

<i>Parallel of Latitude.</i>	<i>Dry season Surface Water.</i>	<i>Width of the Dry flat.</i>	<i>River's Bed. Surface Water in the freshes.</i>
26° 28' N.	1456 yards.	788 yards.	2244 yards.
26° 44'	658 do	1560 do	2218 do
27° 18'	850 do	3004 do	3854 do

The double banks accompany the Indus after it has left the mountains at Kalabagh for the remainder of its course. Were the permanent continuous, the inundation would be restricted to narrow and defined limits; but as this is not the case, I will endeavour to point where this barrier is broken or wanting.

From Attock to Kalabagh.—No inundation.

From Kalabagh to Mittun.—It may be generally remarked, that in the northern part of the Upper Indus, there is no inundation, while in the south, or lower part of its course, the flooded districts are of a considerable extent, as a reference to the chart will shew.

Mittun to Bukkur.—Neither on the east or west banks of this division is there an outer bank, and the consequence is, that the country here is largely inundated. In the Mozarry districts, the floods of 1837 fell twenty miles back from the river; but in ordinary seasons twelve is the more usual measure of their width. On the opposite bank, the inundation about Subzalkote reaches to the edge of the desert.

Bukkur to Sehewan.—Though the permanent banks may be traced in this section, their outline is broken, and the low districts behind them overflowed in the freshes. South of Sehewan inundation of the west bank is general, though the quantity of uncovered land exceeds that submerged. Chandkote, the most valuable province in Sinde, is situated here, and its exuberant crops are to be attributed to its great command of water. Upon the opposite bank, between the river and the desert, is a strip of alluvium, the medial width of which is four miles. This belt marks the extent of the flooded districts; but for some years past, there has been scarce any inundation upon this side of the river.

Sehewan to efflux of Fulailee.—The Tela mountains for some distance below Sehewan prevent the river from expending in a westerly direction, and a creeping hilly ridge serves the same purpose further South. On this side of the river, the inundation is confined to a very narrow belt; on the opposite side the desert opposes any outlet to the East, and here, though the inundated belt be wider than that upon the West bank, its breadth cannot be estimated at more than three miles.

Efflux of Fulailee to the Sea.—The Delta of the Indus may be said to commence from the efflux of Fulailee. The lower portion

of it only is under water, and the inundation here as in the upper course of the river is partial; the submerged part is a belt fringing the sea, measuring in width about twenty miles.*

X.—*Fords of the Indus.*

There are properly speaking no fords on the Indus below Attock, that is, there is no spot in its course where their annual occurrence is so certain as to warrant a dependence on their existence in any subsequent military operations, of which the banks of this river may become the scene.

But that the Indus is at times fordable is certain, and in the course of my inquiries on the subject, I have met with many individuals who assured me of having done it. What may be done once, may be performed a second time, and when a solitary unassisted *Moohaud* can cross, it is just as possible that a regiment of infantry may follow. A ford open to a foot soldier, would prevent no difficulty to horse. The practicability of fording the river being once admitted, becomes a subject of importance, and viewing it in this light, I shall devote more space than I otherwise should to its consideration.

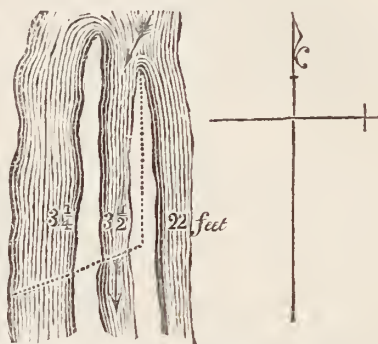
The months in which the river is fordable, are December, January, February, and March. No instance is on record of its having been done either north of Mittun, or south of Hyderabad in Sindh. The Indus does not within the excluded track run deeper than in that portion of its course where the river is known to be fordable; but being less frequented by the boatmen, its capabilities are not so generally known.

The fords are discovered by the annual fleet of grain boats, which descend in the cold weather from the Upper Provinces to Lower Sindh. Some boats in this fleet are of so large a draft, that their safe navigation calls for the most minute survey of the river's channels, and it is whilst so employed that the boatmen sometimes find they have crossed, almost unknown to themselves, from one bank of the river to the opposite, without once having had to swim.

* These observations on the inundation of the Indus south of Mittun are given with much deference, as I have not had proper opportunity of inquiry. This does not apply to any remarks on this subject above Mittun.

During the dry season of 1836-37, I had frequent intimation of fords ; but was not fortunate enough personally to discover one, for it so happened, that by the time I had got to the spot, they had always disappeared. The following sketch is taken from a trust-worthy person, whom I had sent to report on a suspected locality :—

Ford in the neighbourhood of Halá.



The centre channel is here the continuous one ; that on the east side was however the deepest, and discharged the most water ; but its mouths were closed up by shoals. Forty-two boats were lying above the ford, waiting for the channel to open ; this was on the 27th February. The dotted line shews the ford. On this subject I am glad to have the testimony of Dr. Gordon, the officer who went from Loodiana to Bombay with the Maharajah's (Runjeet Sing) mercantile speculation. He tells me, that some distance north of Hyderabad, he came upon a shoal stretching completely across the river, when many grain boats unable to pass over it, were lightening their draft by transporting a portion of their cargo into smaller boats. Dr. Gordon finding more water above the shoal than the boats in his charge drew, held on his course.

The custom of bridging the Indus by boats at Attock, has prevailed since the days of the Greek invasion, and it appears to me, that the same might be used with equal success to cross an army much lower down the river.

The place most adapted for this purpose, whether viewed merely with reference to the river itself, or to the Afghan Passes that lead down upon it, and which have not been unaptly termed the gates of Khorassan, is Bukkur fort. Here we have a permanent channel, both

banks of the river being faced with hard flint hillocks, while in the middle of the stream are some islets of the same material, on one of which is the ford, and contiguous to it, or rather adjoining it, another, containing the tomb of Peer Khaja Khizr. At no other spot below the mountains, does the Indus present similar facilities for bridging. The channel here is as follows :—

Above the fortress the river widens to..... . . . 1244 yards.

In a line with the fort it is less, say 1000 do.

The channel between the fort and the west
bank of the river, is by measurement..... 98 do.

Ditto ditto on the opposite side of the fortress,
estimated 400 do.

Width of fortress and Isle of Khaja Khizr, 502 do.

1000 do.

Depth of the Channels.

West Channel 98 yards measurement.
Current 2.9 knots.
5, 6, 7, 9, 12, 15, 9, 3 feet.



East Channel 400 yards ; estimated
Current 3.7 knots.
7, 7, 9, 9, 9, 12, 12, 13, 15, 18, 30, 24, 12 ft.

A spit projects from the north-west end of the fortress, and extends to within fifty yards of the west bank. In this gut the current is four knots an hour, the depths were 6 6 7 7 6 6 6 5 5 feet ; at the time these measurements were made, the river had 12 feet more to rise. In fact it was. when at its lowest level.

Last June I had an opportunity of examining this bridge of boats at Attock, it contained thirty-six boats, and the river, when they were moored, had a width of 540 feet, its depth by measurement taken the preceding year was 10 fathoms, and the current about 6 knots an hour. By comparing this account of the Attock bridge, with the details of the river at Bukkur, it is evident that circumstances are greatly in favour of the former ; but surely, if a few untutored boatmen succeed so well at one place, we ought not to despair of our success at Bukkur.

The chief, in fact the only difficulty is, mooring the boats, and to effect this, the Seiks use an anchor of a form the very worst that could be imagined, and which has no other recommendation than its antiquity, and perhaps the ease with which it can be dropped from the boats. The figure is pyramidical, a skeleton of wood filled with stones. These uncouth things, when once let go, cannot be recovered, and as the strength of the bridge is not proof against that of the current in June, July, August, and September, a new set has to be made as often as the bridge is required to be constructed. Now were a line of mooring anchors once laid down in place of these wooden baskets, and beyond chain bridles attached to them, a bridge of boats could be put together in about as many hours, as days and weeks are now consume in preparations.

The number of boats required to form a bridge, would be built of a form the best that science could propose, and always kept in a state of readiness to haul out to their several berths, numbered as the buoys would be, 1, 2, 3, &c. A bridge so formed, would be a very solid construction, and able to brave, under proper superintendence, the strongest freshes in the Indus, whether abreast of Attock or under the fort at Bukkur. Should it become necessary to destroy it, one end of the bridle chain has only to be slipped and the mooring anchors are useless to an enemy. But little weight is due to the opinion of men, who not conversant with military affairs, cannot be expected to have clear ideas on such a subject. But still I venture to hold the opinion, that bridging the Indus at Bukkur, is a practicable question.*

The difficulty would be to moor boats in the eastern channel; but this once accomplished, the bridge might be made permanent, as the small western channel might serve for the navigation of the river.

XI.—Of a Site for a Fair.

While Government has it in contemplation to establish an *entre-pôt* for trade on the banks of the Indus, it will not be irrelative

* I need not observe that this was written before Capt. Thompson (Bengal Engineers) threw his noble bridge across the river, by which the British army crossed in 1838, with their baggage and battering train.

to the subject of this report, briefly to say a few words on the locality of those towns where the mart is likely to be fixed.

This question will perhaps be ultimately decided more by the existing foreign relations of the different towns, at the time when this selection is made, than with reference to their geographical position, or their local site. Shikarpoor has hitherto been excluded from the list of places best adapted, to answer the purpose of Government ; but in the turn which current events may give to the political relations of Afghanistan, that town may yet become one of the *entrepôts* for the trade of Central Asia.*

Shikarpoor is not destitute of collateral advantages. The large money transactions of its bankers; the extent and skilfully organized agency which they have diffused, are known to all interested in these matters; though the advantages of such an establishment can be duly appreciated by merchants themselves. With steamers upon the Indus, the proximity of the town to Bombay, the market for Europe goods is favourable to its site as a mart; and were Bukkur fort in our possessions, the British flag upon that fortress would win confidence by guaranteeing security.

The *Zeearat* of Khaja Khizr, a *peer*, alike worshipped by Mahomedan and Hindoo, adjoins the fort of Bukkur, and on the anniversary of a certain day in April, multitudes of both creeds flock to this shrine. Opposite, in the town of Roree, is a place of pilgrimage of still greater sanctity; for here, say the faithful, is preserved a lock of the prophet's hair.

The distance of Shikarpoor from the river, operates unfavorably to its becoming a commercial mart; it lies eighteen koss inland of its port of Shukur. From May to September inclusive, boats can come up to the town by means of a fine canal, called the Sinde, and were this work deepened and connected with the Larkhana canal or the Noroab canal of the Indus, we should have an inland navigation throughout the year, between Sehewan and Shikarpoor. It would traverse the richest portion of the Sindian territories, and evade an intricate passage of 100 coss upon the main river. So admirably is the country adapted for this means of transit, that

* It is a proof of Lieut. Wood's judgment and sagacity, that his supposition is now in course of fulfilment.

throughout the entire line, not a single loch is necessary, save for occasionally cleaning the canal. The returns would be great, and the outlay very moderate compared to that of similar work in countries where natural obstacles have to be surmounted, and labour is a more valuable commodity than in Sind.

The country around Shikarpoor is subject to inundation; but west of the town, and contiguous to the suburbs, is a dry plain, where buildings to any extent could be erected.

I do not believe there is a healthy spot on the banks of the Indus; in this respect there is little choice; some towns have ailments peculiar to themselves; but from the day the river begins to fall in September to the end of November, asthma and fever are common, from the mountains at Kalabagh to the sea.

Bukkur fort and Roree are built upon hillocks of flint, which though not high, render both these places more healthy than towns in the plains. The first is a fortified islet amid channel, and Roree overhangs the left bank of the river, with a depth of four fathoms water under the walls. As a *depôt* for military purposes or an *entrepôt* for commerce, much could be written in favour of both these places.

Mittun.—The geographical position of Mittun is superior to that of any town upon the Indus. In addition to commanding of both the Indus and Punjaub streams, it stands midway between the gates (as the natives term them) of Khorassan, namely, the passes of Bolan and Sakhi Surwar, while immediately behind it are the entrances of the former pass by the auxiliary routes of Assui and Hunnund. The town is built upon a small artificial mound, and when the freshes are in the river it is surrounded on three sides by water; it is two miles distant from the Indus, but from the middle of June to the 22d of September, boats can discharge or take in cargo immediatly under the town, by means of a fine natural water-course, navigable down the Bangalah and Omerkote. South of Mittun, is a dry plain that fringes the above nullah; and should this town be preferred for the site of a fair,* it is on the bank of this stream that booths and other buildings should be erected. During the inundated months, camels cannot travel north or west of Mittun. The inhabitants prefer well-water to that of the Indus. When

* Since selected for the purpose.



the river has been falling for four or five successive days, to drink the nullah water is almost certain to bring on an attack of illness ; this the natives attribute, and I think very properly, to the vegetable matter which must be brought into the water-course, by the drainings of the inundated districts. Mittun, and the village of Chatchur upon the opposite bank can, taken together, supply forty boats of from one hundred maunds burden to one thousand.

I ought before to have said that cutaneous eruptions trouble the inhabitants of Mittun ; the sores frequently become ulcered, but though difficult to heal, the disease does not appear to affect the general health.

Dera Ghazee Khan.—This town has been more than once endangered by the inundation when Nawab Jubber Khan, the brother of Dost Mahomed Khan of Cabool, was governor of the province ; a wall that surrounded the town had to be thrown down to keep the water out, nor is there within a circle of many miles a spot exempt from its effects. Dera Ghazee Khan is situated about four miles from the river ; but in the swell, like most of the other towns upon the Indus, it has a large navigable canal, by which it may be approached by boats for some months. Dera Ghazee Khan has, however, advantages that it will be difficult to set aside ; the town lies at the foot of a pass in the Soliman mountains, that leads both to Cabool and Candahar, while it is equally central with respect to the Indian routes. It is the largest town upon the Indus, and even under the Sikh rule, it wears an appearance of increasing prosperity. Its merchants, though they do not speculate largely, have an extensive agency, and a considerable command of money. The country around yields heavy crops of grain, and the staples of cotton and indigo, while its home manufactures of silken stuffs, such as gool buddens, timorees, &c. is only equalled by the manufacturing marts of Bhawalpoor and Moultan. When to the above recommendations are added, the fairs at Peer Adul and Sakhi Surwar, I believe that every thing considered, Dera Ghazee Khan, or rather some spot in its vicinity, will at once be considered the most eligible place to lay the foundation-stone of an Indian St. Macrera. By a reference to the map it will be seen, that Sakhi Surwar and Peer Adul, are towns in the district of Dera Ghazee Khan ; at each of these places, a large *Mela*, or fair, is annually kept ; that of Sakhi Surwar

occurs in the Indian month Visukh, answering to our March. It is held in honour of the *peer*, after whom the place is named; the fair lasts five days, and pilgrims from India's furthest shores come to prostrate themselves at the tomb of Sakhi Surwar. Few come from the countries west of the Suliman range; and the followers of Brama out-number those of Mahomed; the aggregate of both cannot be much under 100,000 souls. Though commerce is not neglected, there is but little business done.

A Khorassan or Afghan horse-dealer may now and then exchange an animal of his stud for the productions of India, or the manufacture of Europe; but this *Mela* is essentially an assemblage for devotional and pleasurable purposes; but with such a material, and the example of the holy Mecca, it is easy to fortel that (when the fair is established,) many individuals in this annual concourse of devotees will become as enterprising merchants as they are now zealous and bigotted *fakeers*. Sakhi Surwar is twenty-four koss nearly direct west of Deera Ghazee Khan; it is a considerable town situated in the mouth of the pass. Firewood is abundant, and a mountain rivulet supplies the town with water. At Peer Adul Zeearat, seven koss in a N. W. direction from Dera Ghazee Khan, a fair is held in February, similar to that of Sakhi Surwar.

Dera Ismail Khan is never inundated from the river, but is yearly flooded by mountain torrents. The present town lies about a mile back from the river, and was built about eight years ago, when the old Dera was washed into the Indus. Dera Ismail Khan is well planned, and when its skeleton streets are filled with occupants, they, for width and cleanness, will match with those of most eastern towns. The houses are of mud or sun-dried brick, terrace roofed, and rise from a ground platform of from one to two feet high. Few are of more than one story. When I passed through it in the middle of summer, the bazar was well frequented; but in the winter months it is much more thronged. The town is a sort of nucleus or rallying point for those pastoral tribes of Affghanistan, who prefer a clement winter in the valley of the Indus, to the security of that which characterizes that of the mountain districts of their own land. Carriage is thus almost unlimited, as some of the tribes rear camels for no other purpose than to put them out to hire. The *Lohanas*, who from before the time of Baber

have been the great carriers and traffickers of these countries, still frequent Dera Ismail Khan. The transit trade of India and Affghanistan is already fixed here, and if the routes radiating from the town are considered merely in reference to Cabool, then is Dera Ismail Khan better situated for a commercial mart than towns lower down the river.

These are all the places that present themselves as eligible spots for the establishment of commercial *depôts* west of the Indus; but should it ever become an object to Government to have the mart within their own frontier, then Leia, upon the Indian bank of the river, lying between the two Deras, is its proper site.

But to give full effect to these fairs, it is desirable that two be established, one for the lower Indus and one for the upper; the latter will supply, besides the markets of Affghanistan, those of Central Asia beyond the Parapamisan chain. The other, by the roads of Kandahar* and Kelat,* will draw from Beloochistan, the districts around Herat, and the southern provinces of Persia, their staples of wool, assafoetida, and madder; while in return, it can supply the whole of this extensive region with the growth of India and manufactures of the British Isles, at a cheaper rate than can be done by any other route. Thus, should a general war in Europe exclude England from the Black Sea, an outlet equally good for the staples of her trade is offered by the Indus, with an *entrepôt* at Bukkur and another in the Derajat.

XII.—*Indus and Punjaub Rivers.*

Travelling over the Punjab, in a westerly direction, when its rivers are in flood a little above the parallel of Kalabagh, no less than five streams are crossed, each occupying a larger bed, and seeming to the eye, a more important river than the Indus.

The Punjab rivers, as are well known, fall into the Indus in one stream, and if we call our attention to the confluence of the united volume with the latter, the result is strikingly at variance with appearances and pre-formed opinions.

* The port of Sommeeanee seems by recent accounts to be most favoured by importers, and I understand that merchants are only awaiting the pacification of the country, to commence carrying thence, *via* Biela and Kelat.

About the middle of May, I examined both when the relative size of the Indus and its Indian feeds stood as follows :—

<i>Indus, or Sinde.</i>	<i>Chenab, or Punjaub.</i>
Width 608 yards, max. current 4.8 knots, $\frac{3}{4}.1.1.1.1.1.\frac{1}{4}.1\frac{1}{2}.1\frac{1}{2}.1\frac{3}{4}.$ $2.2.2\frac{1}{4}.2\frac{1}{4}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{4}.2.2\frac{1}{2}.2.$ $1\frac{1}{4}.1.\frac{3}{4}.\frac{1}{2}.$ fathoms. Discharge per second 91.719 cubic feet.	Width 1766 yards, current 1.8 knots, $2\frac{1}{2}.2.2.1\frac{3}{4}.1\frac{1}{2}.1\frac{3}{4}.1\frac{1}{2}.2.1\frac{1}{2}.2\frac{1}{2}.1.$ $1\frac{1}{2}.1\frac{1}{2}.1\frac{3}{4}.2.2.2\frac{1}{4}.2.1\frac{1}{2}.2.2\frac{1}{4}.2.1\frac{1}{2}.2.$ $2\frac{1}{4}.2\frac{1}{2}.1\frac{1}{2}.1\frac{3}{4}.1\frac{1}{2}.1\frac{1}{4}$ fathoms. Dis- charge per second 68.955 cubic feet.

Here the principal cause of the disproportionate size of the Indus is the early commencement of its freshes. Indebted for its periodical rise principally, if not solely, to snow-clad mountains, an increase is first perceived in its stream when the sun comes into our northern latitudes at the vernal equinox in March; but the Punjaub rivers depending upon theirs upon another and less constant source, namely, the rainy season of Hindostan, have their freshes later. At the time of my examination in May, the Sutlej, the most eastern of the Punjab rivers, was at its lowest level; while the Jalum, the most western of the five rivers, and the one which has its source nearest to that of the Indus, had already shewn signs of rising; from which I am inclined to think, that measurements made in July would give, if not an entirely different, a less disproportionate result in the amount of water discharged by the Indus and its Punjaub auxiliaries.

But that the Indus is a superior river to the Punjaub, seems very clear; and amongst the collateral proofs of this which may be urged, is the direct nature of its course, compared with those of the Punjaub streams. Also the dread in which the river is viewed by the *Mohanas*, who, were the choice left to themselves, would prefer dragging their boats twenty coss up the Chenaub, to half that distance upon the Sinde.

Another circumstance connected with these two rivers is worthy of notice; in the Doab, or country lying between them, all canals are cut from the Sinde, in the month of July, when both rivers are in the flood, the surplus water of the Sinde pours down into the Chenaub, proving that though their beds for a distance of sixty miles are not more than ten miles asunder, yet that in their relative level, there is a considerable difference.

It appears to me, that Captain Burnes must have erred in giving so large a fall as twelve inches a mile to the Punjaub streams, and but half that quantity to the Indus. In the dry weather, the latter river has most decidedly a much stronger current, than any of these streams, and even in the freshes, their current as far as I have been able to observe the Punjaub rivers, is not so strong as that of the Indus. On the 27th of June this year, the current of the Roree at Lahore was not more than three knots an hour, and neither that of the Jalum or Chenaub exceed four.

XIII.—*Concluding Remarks.*

It has been matter of regret, that so noble a river as the Indus, should have no port accessible to vessels of burden.

The disappointment is, however, more imaginary than real. If indeed the merchant is necessitated to employ ships of 4 and 500 tons burden, such a class of vessels cannot enter the river, and he must land his goods at Curachee, the only port in Sind open to vessels of this description; but if, on the contrary, he prefer water carriage to land portage, why not avail himself of tonnage? In the fair season, hundreds of boats frequent the mouths of the Indus; they are the common coasting vessels of Cutch, and none of them exceed, when laden, a draft of nine feet. The average draft is six and seven. I believe that the principal mouth, namely, one that discharges the greatest body of water, will even be found the least navigable, and that the port of the Indus, though it may fluctuate between the Luckput creek and Curachee, will always be situated in a secondary branch, discharging little or no fresh water, but connected with the main stream by a creek or navigable channel, open only to the flat boats of the river. But even admitting that a vessel drawing seven feet water could get upon the main trunk, nothing would be gained, as no other description of vessel but the light drafted steamer already noticed, will be found to answer upon the Indus, and such vessels will be able also to keep up the communication between the sea-going craft and the main river. If then a portage is thus shewn to be unnecessary merely to give free access to the river, it is equally useless by way of avoiding the difficulties of navigation in any

particular part of its course. In my former report, I did indeed advocate the plan, but I did so then from hearsay. Now I give the result of my own observation. The navigation of the Delta is certainly intricate; but the difficulties are not so insurmountable to render a portage desirable, nor does the river improve so much above it, as I was at the time given to understand.

In one respect, the authorities on the river have it in their power to confer a considerable boon on the navigation of the Lower Indus. The only obstacle in the river, from which danger is to be apprehended, and which no attention can effectually guard against, is sunken trees. Now the river brings down none of these from the mountains. All come from the *shikargah*, or hunting preserves of the Sinde Ameers. The supply might be cut off without material injury to these forests, or interfering with their Highnesses' amusements. Let the Ameers but give an order, that between the *shikargah* and the river, a clear belt of twelve yards wide be left, and in a few weeks their numerous foresters will have cut down a twelve months' fuel for our steamers, and insure a path for the trackers.

As these forests do not extend north of Sehewan, the operation would not require to be carried above that town, the jungle wood there being too small to affect the channels of the river.

TABLE No. I.

Comparison of Chronometers.

Date.	Chronometers.		Differences.	
	No. 256.	No. 257.	1st.	2nd.
1836.				
Dec. 27th	4 18 00	4 31 05	13 ''05	2.0
28th	4 13 30	4 26 37	13 ''07	2.0
29th	4 26 50	4 39 58.5	13 ''08.5	1.5
30th	4 11 15	4 24 25.5	13 10.5	2.0
1837.				
Jan. 1st	4 12 35	4 25 49	13 14	1.7
2nd	4 36 05	4 49 21	13 16	2.0
10th	4 45 35	4 58 06.5	13 31.5	1.9
11th	4 42 35	4 56 08.5	13 33.5	2.0
12th	4 48 20	5 01 55.5	13 35.5	2.0
Feb. 15th	11 51 35	12 06 23.5	14 48.5	2.0
20th	11 18 30	11 34 31.0	15 01.0	2.5
26th	10 49 15	11 04 28.5	15 13.5	2.1
March. 1st	10 48 00	11 03 19	15 19	1.8
5th	11 09 50	11 25 16	15 26.0	1.9
9th	4 38 00	4 53 32.5	15 32.5	1.8
April 9th	4 18 30	4 34 59	16 29	0
14th	4 02 21.5	4 19 00	16 38.5	1.9
17th	4 24 14.5	4 41 00	16 45.5	2.3
18th	4 00 12	4 17 00	16 48	2.5
19th	3 49 10	4 06 00	16 50	2.0
20th	3 54 37.5	4 11 30	16 52.5	2.5
27th	3 34 49	3 52 00	17 11.0	2.6
29th	4 00 14	4 17 30	17 16	2.5
May 19th	3 35 56	3 54 00	18 04	2.4
20th	2 51 53.5	3 10 00	18 06.5	2.5
1838.				
July 16th	9 59 00	5 47 07.5	4 11 52.5	3.5
17th	8 03 00	3 51 05	4 11 55	2.5
18th	9 56 58	5 45 00	4 11 58	3.0
19th	9 43 00	5 30 59	4 12 01	3.0
20th	7 43 00	3 30 56	4 12 04	3.0

TABLE No. 2.

From Mittun to Dera Ghazee Khan. The Time-keepers were examined at Mittun, and again at Dera Ghazee Khan. The following Table shews the result of each rate, while for the Longitude it gives a Mean of both.*

Stations.	Latitudes.	Diff. Longitude by		Mean.	Longitude.
		Mittunkote.	Dera Ghazee Khan.		
No. 1	28°58'25" N.				
2	29°04'38"	03°57'	04°21'	04°9'	70°30'34" E.
3	29°04'49"	10°45'	11°10'	10°37'	37°22'
4	29°23'44"	12°54'	13°31'	13°12'	39°37'
5	29°31'53"	25°36'	26°20'	25°58'	52°23'
6	29°42'00"	25°15'	26°01'	25°38'	52°3'
7	29°53'00"	28°34'	29°20'	28°57'	55°22'†
8	30°06'02"	27°34'	28°04'	28°4'	54°29'

Dera Ghazee to Dera Ismail Khan. The Watches were examined at these places, and the following Table gives the Longitude of the intermediate stations, deduced from a Mean of the old and new rates.

Stations.	Latitudes.	Diff. of Longitude by rates.			Longitude.
		Old.	New.	Mean.	
No. 1	30°33'19"	02°00' E.	01°51' E.	01°55' E.	70°56'24" E.
2	30°56'49"	01°00' W.	01°18' W.	01°09' W.	70°53'20"
3	31°09'09"	01°10' E.	00°39' E.	00°52' E.	70°55'24"
4	31°24'55"	04°42'	04°24'	04°33'	70°59'02"
5	31°37'16"	09°57'	09°21'	09°39'	71°04'08"
6	31°42'30"	05°03'	04°24'	04°43'	70°59'12"
7	31°47'54"	06°30'	05°50'	06°10'	71°00'39"

* Mittun was fixed from Roree.

† Indifferent.

TABLES,

In which the Geographical position of points and places in the line of the Indus, as they stand in the published Maps, are compared with the Observations of the present Mission.

No. 3.

From the Sea to Mittun.

Places.	Latitude.		Longitude.	
	Map.	Mission.	Map.	Mission.
	° ' "	° ' "	° ' "	° ' "
Barree Gorah, ...	24.12.00 N.	24.13.20 N.	67.54.30 E.	67.36.00 E.
Efflux Hejamree,	24.08.42	24.16.42	67.57.00	67.47.03
Tatta Bunder, ...	24.44.00	24.44.30	68.19.00	68.01.06
Hydrabad do. ...	25.22.00	25.22.04	68.41.00	68.23.03
Sehewan do.	26.22.00	26.22.35	68.09.00	67.55.17
Roree do.	27.43.29	27.41.59	68.56.00	68.55.39
Chatchur do.	28.53.29	28.52.07	70.31.00	70.27.57
Mittun do.	28.54.00	28.53.19	70.29.00	70.26.25

No. 4.

Mittun to Attock.

Places.	Latitude.		Longitude.	
	Map.	Mission.	Map.	Mission.
	° ' "	° ' "	° ' "	° ' "
Nowshaira,	29.11.00 N.	29.12.19 N.	70.38.00 E.	70.35.28 E.
Raick,	29.21.00	29.24.20	70.45.00	70.39.01
Sherroo,	29.42.00	29.42.00	70.58.00	70.50.03
Dera Ghazee Khan,	29.58.00	30.03.26	71.00.00	71.51.23
Dera Dean Pemah,* ...	30.40.00	30.33.19	71.06.00	71.00.24
Ditto,†	30.51.30	30.39.20	70.57.30	
Leia,	31.08.00	30.58.01	71.05.00	70.59.23
Rajun,	31.14.00	31.08.39	71.06.00	70.57.42
Khahree,	31.30.00	31.24.25	71.01.00	70.54.02
Bukkur,	31.44.00	31.37.16	71.14.00	71.06.28
Dera Ismail Khan,	31.57.00	31.48.39	71.07.00	70.59.30
Kalabag,	33.07.00	32.57.36	71.49.00	71.35.23
Confluence of Sehewan, ...	33.10.00	33.01.48		
Attock,	33.55.40	33.53.53	72.27.00	72.16.27

* East bank.

† West bank.

TABLE No. 5.

Sectional or Cross River Soundings. 1st, in the Delta in the months of December and January.

Parallel of Latitude.	Soundings.	Widths.
24° 17' N.	5.6.7.6.5½.5.4½.4.4.3.2.2.2.1¾.1½.1.1½ fathoms....	
19	¼.2.3½. 4.4½.6.5½.5½.6. 4.3½.3½.3.3.2½.2½.2¼.2.2. 2.2.2½.	734 yds.
21	1½.1½.2.3.3½.3½.1½.1½.2.2.3.2½.2½.2½.2. ...	631
26	1½.1½.1½.1½.1½.1½.1½.1½.1½. 1.1½.1½.1½.1½.1½.1½.1¾. 1¾.1¾.1¾.1¾.1¾.1¾.1½....	455
28	1.1.1.1¼.1½.1¼.2.2¼.2.2.2.2.1½.1½.1½.1.½. ...	1277
34	¾.¾.¾.¾. 1.1¼.1¼. 1½.1½.1¼. 1¼. 1½.1¾.2.2.2.2¼.2¼. 2¼.2¼.1.1.1.½.½.	
37	1.1.1.1. 1.1¼. 1¼.1¼. 1¼.1¼.1.1.1.1¼.1½.1.1.1.1.1¼. 1.1.1.1.1.1.1.1.1.1.1.1.1.1.¾.¾.½.½. ...	841
44	1.1.1.½.3.3.3.4½.3½.3.2.1½.1.1.1.1.¾.¾.½. ...	691
47	½.½.½.¼.¼.½.½.¾.1.½.2.3.3½.3½.3½.3.	
48	½.1.½.½.½. 2.2¼.4. 1.1.1.3.3.3.3.3½. 3½.2½.2.1¾.1.1. 1.½. 1007 dry. 1.1.1.1.½.	1132
50	1.2.2½.2.2.1½.1½. 1.2.2.1¼.2.2.2.1¾.1½. 1½.2.1.1.1. 1¼.2.¾.	

Between the Delta and Schewan, in the months of January and February.

Parallel of Latitude.	Soundings.	Widths.
54	1.1. 1¼.1¾.2.1½.1.1.1.1¼. 1.1¼.1¼. 1½.1½.1½.1½.1½. 1¾.2.1½.1.	780 yds.
58	1.1.1½. 1¾. 2.2. 2. 2.2.1¼. 1.¾.¾. ¾.¾. ¾. 1.¾.⊙ 1.1¼.1.1.1.2.1¾.1¼.1¼.¾.½.	978

Between the Delta and Sehewan, in the months of January and February.—(continued.)

Parallel of Latitude.	Soundings.	Widths.
25° 00'	$\frac{3}{4} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot 1 \cdot 1 \cdot \frac{1}{4} \cdot \frac{1}{2} \cdot 2 \cdot 2 \frac{1}{2} \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \cdot \dots \dots \dots$	834 yds.
13	$1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 3 \cdot 3 \cdot 2 \frac{1}{2} \cdot 2 \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \cdot \dots \dots \dots$	590
19	$3 \cdot 3 \frac{1}{2} \cdot 3 \frac{1}{2} \cdot 3 \frac{1}{2} \cdot 3 \cdot 3 \cdot 2 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \dots \dots \dots$	400
22	$\frac{3}{4} \cdot 1 \frac{1}{4} \cdot 1 \cdot 1 \cdot 1 \cdot \frac{1}{4} \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \frac{1}{2} \cdot$ $\cdot 1 \frac{3}{4} \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \frac{3}{4} \cdot \odot \cdot 1 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \cdot \dots \dots \dots$	—
25	$4 \frac{1}{2} \cdot 3 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 2 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot \dots \dots \dots$	518
31	$1 \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \cdot \frac{3}{4} \cdot \frac{1}{2} \cdot \dots \dots \dots$	460
35	$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 2 \frac{1}{4} \cdot 2 \frac{1}{2} \cdot 2 \frac{3}{4} \cdot \dots \dots \dots$	700
26° 00'	$1 \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 2 \cdot 2 \frac{1}{4} \cdot 2 \cdot 2 \cdot 2 \cdot 1 \frac{3}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \cdot \dots \dots \dots$	522
11	$1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \frac{1}{2} \cdot 1 \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot \dots \dots \dots$	600
16	$3 \cdot 4 \cdot 4 \frac{1}{4} \cdot 4 \frac{1}{4} \cdot 3 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot 1 \cdot 1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \frac{3}{4} \cdot 1 \cdot 1 \cdot$ $1 \cdot 1 \cdot \frac{3}{4} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{3}{4} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \cdot 1 \cdot \frac{1}{2} \cdot \dots \dots \dots$	1000

Between Sehewan and Bukkur, in the months of February and March.

Parallel of Latitude.	Soundings.	Widths.
24,	$\frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{3}{4} \cdot 1 \frac{5}{4} \cdot$ $1 \frac{5}{4} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \cdot 1 \frac{5}{4} \cdot \frac{1}{2} \cdot \odot \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot$ $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \odot \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot 1 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 2 \frac{1}{4} \cdot$ $2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot \dots \dots \dots$	1684 yds
28	$\frac{1}{2} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{4} \cdot 1 \cdot 1 \cdot 1 \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot$ $1 \cdot 1 \cdot \frac{5}{4} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{4} \cdot \frac{5}{4} \cdot 1 \frac{1}{2} \cdot 2 \frac{1}{4} \cdot 2 \frac{1}{4} \cdot 1 \frac{1}{2} \cdot \frac{1}{4} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot 1 \cdot 1 \cdot$ $1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot 1 \frac{1}{4} \cdot 1 \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{1}{4} \cdot \dots \dots \dots$	1456
41	$2 \cdot 2 \cdot 2 \frac{1}{4} \cdot 3 \frac{1}{4} \cdot 2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 2 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 2 \cdot 2 \cdot 2 \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{2} \cdot 1 \frac{1}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot$ $1 \cdot 1 \cdot 1 \frac{1}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot \frac{5}{4} \cdot 1 \cdot 1 \cdot 1 \cdot \frac{5}{4} \cdot 1 \cdot 1 \cdot \frac{5}{4} \cdot \dots \dots \dots$	763

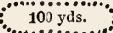







Between Sehewan and Bukhur, in the months of February and March.—(continued)

Parallel of Latitude.	Soundings.	Width.
42'	$1. \frac{1}{2}. \frac{1}{2}. \frac{5}{4}. \textcircled{\cdot\cdot\cdot} \frac{5}{4}. \frac{5}{4}. \frac{5}{4}. \frac{5}{4}. 1. 1. 1. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{2}. \frac{1}{2}.$ $\textcircled{\cdot\cdot\cdot} \frac{1}{2}. \frac{1}{2}. \textcircled{\cdot\cdot\cdot} \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \textcircled{\cdot\cdot\cdot} \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. 1. 1\frac{1}{4}. 2\frac{1}{2}. 2\frac{1}{2}.$ $2\frac{1}{2}. 2\frac{1}{2}. 2\frac{1}{2}. 2\frac{1}{2}. 2\frac{1}{2}. 2. 3. 2. 2\frac{1}{4}. 2. 2\frac{1}{2}. 1\frac{5}{4}. 1\frac{5}{4}. 1\frac{1}{2}. 1. \dots$	1600 yds.
44	$\frac{1}{2}. \frac{1}{2}. 1\frac{1}{4}. 1\frac{1}{4}. 2. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{2}. 1\frac{5}{4}. 1\frac{5}{4}. 2. 2\frac{1}{4}. 2\frac{1}{4}.$ $2. 2\frac{1}{4}. 3. 3. \dots \dots \dots \dots \dots$	658
45	$\frac{1}{2}. 1. 2. 2. 2. 2\frac{1}{4}. 2\frac{1}{4}. 2\frac{1}{4}. 2\frac{1}{4}. 2. 2. 2\frac{1}{4}. 2\frac{1}{4}. 2\frac{1}{4}. 2\frac{1}{4}. 2\frac{1}{4}.$ $2. 1\frac{5}{4}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{5}{4}. 1\frac{5}{4}. 1\frac{5}{4}. 1\frac{1}{2}. \dots \dots$	452
27° 10'	$2. 2. 2. 2. 2. 2. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{2}. 1\frac{1}{2}.$ $1\frac{1}{2}. 1\frac{1}{4}. 1. 1. 1. \frac{5}{4}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \dots \dots$	622
18	$\frac{1}{2}. \frac{5}{4}. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{5}{4}. 2. 2\frac{1}{2}. 2\frac{1}{4}. 2\frac{1}{2}. 2. 2\frac{1}{2}. 3\frac{1}{4}. 4\frac{1}{2}.$ $4. \dots \dots \dots \dots \dots$	850
29	$1\frac{1}{2}. 2\frac{5}{4}. 3. 4. 4. 4\frac{1}{2}. 4. 3. 3. 3. 2\frac{1}{2}. 2\frac{1}{2}. 2\frac{1}{2}. 2. 1\frac{1}{2}. 1\frac{1}{4}. 1\frac{1}{2}.$ $1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. \dots \dots \dots \dots \dots$	690
40	$1\frac{5}{4}. 2. 2\frac{5}{4}. 1\frac{1}{2}. 2. 2\frac{1}{4}. 1\frac{5}{4}. 1\frac{5}{4}. 1\frac{1}{2}. 1\frac{1}{4}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. \frac{5}{4}. \frac{1}{2}. \frac{1}{2}.$ $\frac{1}{2}. \frac{5}{4}. \frac{5}{4}. \frac{5}{4}. 1. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{5}{4}. 2\frac{5}{4}. 2\frac{5}{4}. 2\frac{1}{4}. 2. 2\frac{5}{4}. 3.$ $2\frac{5}{4}. 2. 1\frac{1}{4}. 1. \dots \dots \dots \dots \dots$	1896


Between Bukhur and Mittun, in the month of April.

Parallel of Latitude.	Soundings.	Widths.
27° 58'	$2\frac{1}{4}. 4\frac{1}{2}. 4. 3\frac{1}{2}. 3\frac{1}{2}. 3\frac{1}{2}. 3. 2\frac{1}{4}. 2. 1\frac{3}{4}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{4}. 1\frac{1}{4}. 1. 1.$ $1. \frac{3}{4}. \frac{1}{2}. \dots \dots \dots \dots \dots$	561 yds.
28° 03'	$2. 2. 2\frac{1}{4}. 3\frac{3}{4}. 2\frac{3}{4}. 2\frac{1}{2}. 2. 1\frac{1}{2}. 1. 1. \frac{3}{4}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{1}{4}. \frac{1}{2}. \frac{3}{4}. 1\frac{1}{2}. 1\frac{1}{2}. 2. 2. 1\frac{3}{4}. 2. 2.$ $1\frac{1}{2}. 1\frac{1}{2}. 2. 1\frac{1}{2}. 1. 1. 1\frac{3}{4}. 1\frac{1}{2}. 1. 1\frac{3}{4}. 2\frac{1}{2}. 2\frac{1}{4}. 1\frac{1}{2}. 1\frac{1}{4}. 1. \frac{3}{4}. \frac{1}{2}. \frac{1}{2}. \frac{1}{2}.$ $\textcircled{\cdot\cdot\cdot} \frac{1}{2}. \frac{3}{4}. \frac{1}{2}. \dots \dots \dots \dots \dots$	1067
08	$1. \textcircled{\cdot\cdot\cdot} \frac{1}{2}. \frac{1}{2}. \frac{1}{2}. \frac{3}{4}. \frac{1}{2}. 1. 1. 1. 1\frac{1}{4}. 1\frac{1}{4}. 1\frac{1}{2}. 1\frac{1}{4}. 2. 2\frac{1}{2}. 2\frac{1}{2}. 1\frac{3}{4}. 1\frac{1}{4}. 1. 1. \frac{3}{4}.$ $\frac{3}{4}. \frac{1}{2}. \frac{1}{4}. \frac{1}{2}. \frac{1}{2}. \frac{3}{4}. 1. 1\frac{1}{4}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{1}{2}. 1\frac{3}{4}.$ $1\frac{3}{4}. 2. 2. 2. 2. 2\frac{1}{4}. 2\frac{1}{4}. 2\frac{1}{4}. 2. 1\frac{1}{4}. 1\frac{1}{2}. 1. 1\frac{3}{4}. 2. 2\frac{1}{4}. 2\frac{1}{2}. 3\frac{1}{4}. 3. \dots$	1123

Between Bukkur and Mittun, in the month of April.

Parallel of Latitude.	Soundings.	Widths.
15'	$1\frac{1}{4}.1\frac{1}{2}.1\frac{1}{2}.1\frac{3}{4}.2.2\frac{1}{4}.2\frac{1}{2}.3.2\frac{1}{4}.2.2\frac{1}{4}.2\frac{1}{4}.2.2.2.2\frac{1}{4}.2.2.3.1\frac{3}{4}.$ $1\frac{1}{2}.1\frac{1}{4}.1\frac{1}{4}.1.1\frac{1}{4}.1\frac{1}{2}.1\frac{3}{4}.1\frac{3}{4}.1\frac{3}{4}.2.2.1\frac{3}{4}.1\frac{3}{4}.1\frac{1}{2}.1\frac{3}{4}.1\frac{3}{4}.1\frac{1}{4}.1\frac{1}{4}.$ $1.1.\frac{3}{4}.1.1.1.1.1.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.$  $\frac{1}{2}.\frac{1}{2}.\frac{3}{4}.\frac{3}{4}.\frac{3}{4}.\frac{3}{4}.1.1\frac{1}{2}.$ $1\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{3}{4}.\frac{3}{4}....$ 1969 yds.	
17	$\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{4}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{3}{4}.\frac{3}{4}.1.1.1.1.1.1.1.1.1.1.1.$ $1.1.1.1\frac{1}{2}.2\frac{1}{2}.2\frac{3}{4}.3.3\frac{1}{2}.4.4.4\frac{1}{2}.4.4\frac{1}{2}.3\frac{1}{2}.1.2\frac{3}{4}.1\frac{3}{4}.3.3\frac{1}{4}.4.4.1.$ $1.\frac{3}{4}.\frac{1}{2}.$ 663	
30	$1.1.1.\frac{3}{4}.\frac{3}{4}.1.1.1.1.\frac{3}{4}.\frac{3}{4}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.$  $\frac{1}{2}.$ $\frac{1}{2}.\frac{3}{4}.1.1.1\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.$  $\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.$  $\frac{1}{2}.\frac{1}{2}.\frac{3}{4}.1\frac{1}{4}.1\frac{1}{4}.1.1.1\frac{1}{2}.$ $1\frac{1}{4}.1\frac{1}{2}.2\frac{1}{4}.1\frac{1}{4}.1.1.1.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{4}.$ 1685	
36	$1\frac{1}{4}.1.1.\frac{3}{4}.2.2.2.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.$ $2\frac{1}{4}.2\frac{3}{4}.2\frac{3}{4}.2\frac{1}{2}.2\frac{1}{4}.2\frac{1}{4}.2.2.2.1\frac{3}{4}.1\frac{3}{4}.1\frac{3}{4}.2.2\frac{1}{4}.2\frac{1}{4}.1\frac{3}{4}.1\frac{1}{2}.1.1.1.$ $\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.$  $\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.$  $\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{3}{4}.\frac{3}{4}.1.1.1.1\frac{1}{4}.1\frac{1}{4}.$ $1\frac{3}{4}.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{4}.1\frac{1}{4}.1.1.1.1.$  1859	
43	$2\frac{1}{4}.2\frac{1}{4}.2\frac{1}{4}.1.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{2}.2.2.2\frac{1}{4}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{4}.2\frac{1}{4}.2.$ $1\frac{3}{4}.1\frac{1}{2}.1.1\frac{1}{4}.1\frac{1}{2}.2.2\frac{1}{4}.1.1\frac{1}{4}.1\frac{1}{2}.1\frac{1}{2}.1\frac{3}{4}.2.2.2.1\frac{1}{4}.1.2\frac{3}{4}.2\frac{1}{2}.2\frac{1}{2}.$ $2\frac{1}{4}.1\frac{3}{4}.1\frac{3}{4}.1\frac{1}{4}.\frac{3}{2}.$  1323	
52	$\frac{3}{4}.1.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{2}.1\frac{1}{4}.2.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{2}.1\frac{3}{4}.2.$ $2.2.1\frac{1}{2}.1\frac{1}{4}.1.1.\frac{3}{4}.\frac{3}{4}.\frac{1}{2}.1\frac{1}{4}.\frac{1}{4}.\frac{3}{4}.1.1.1\frac{3}{4}.1.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{2}.1\frac{3}{4}.1\frac{3}{4}.$ $2.2\frac{3}{4}.3\frac{1}{4}.5.6\frac{1}{2}.7.5\frac{1}{2}.4\frac{3}{4}.6.4\frac{3}{4}.4\frac{1}{2}.4\frac{1}{2}.$ 995	

Between Mittun and Kalabagh, in the months of May, June, & July.

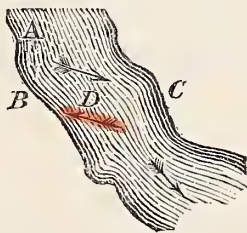
Parallel of Latitude.	Soundings.	Widths.
58'	$\frac{1}{2}.\frac{3}{4}.1.1\frac{3}{4}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{3}{4}.\frac{3}{4}.1.1.1.1.1.1.1.1.1.1.1.1\frac{1}{2}.1\frac{1}{2}.2.2\frac{3}{4}.2\frac{1}{2}.2\frac{1}{2}.$ $2\frac{3}{4}.2\frac{1}{2}.$ 600 yds.	
29° 04'	$1.1.1.1.1\frac{1}{2}.1\frac{1}{2}.2.1\frac{1}{2}.1\frac{3}{4}.2.2.2.2.2.4.7.2\frac{1}{4}.$ 635	
12	$1.1\frac{3}{4}.2.2.2.2.1\frac{3}{4}.1.1\frac{1}{4}.1\frac{1}{4}.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{2}.$  $\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.\frac{3}{4}.1.1.1.1.1.$ $1.1\frac{1}{4}.2.2.2.2.2\frac{1}{2}.2\frac{1}{2}.2\frac{1}{2}.2\frac{3}{4}.2\frac{1}{2}.2\frac{1}{2}.2.2.1\frac{3}{4}.1\frac{1}{2}.1\frac{1}{2}.1\frac{1}{4}.1\frac{1}{2}.1.1.\frac{3}{4}.\frac{1}{2}.\frac{1}{2}.\frac{1}{2}.$ 1132	

	<i>Current.</i>			miles.	yards.
The usual current in the freshes is,	5	992
When the freshes are strong,	6	1272
The greatest measured velocity,	8	323
Between Attock and Kalabagh, where the river is hem-					
med in by mountains, it is estimated in the freshes,	10	
In the dry season usual,	2	1376
Ditto ditto strong,	3	1248

In a channel 1855 yards wide, the current in the middle of July has been found to vary its strength in different depths as follows:—

$\frac{1}{2}$ fathom	.....	2·7 knots.
$\frac{3}{4}$ do.	.....	3·4 do.
1 do.	.....	4·7 do.
$1\frac{1}{2}$ do.	.....	2·9 do.
2 do.	.....	4·8 do.
$2\frac{1}{4}$ do.	.....	5·8 do.

By experiments with Massey's patent Log Machine, the ground current of the Indus has been found equal in velocity to that of its surface.



When the stream *A* encounters the bank at *B*, it is thrown off in the direction *C*; that part of the bed called *D* is thus cut off from a further supply. An irregularity in the level is the immediate consequence, to restore which, a surface stream rushes up, as represented by the coloured arrow in the figure; but as the water at the bottom of the surface *D* runs off by the declivity of the river's bed, no equilibrium can take place, while a rotatory motion, fatal to the bank, is given to a large body of water in its immediate vicinity.

TABLE No. 7.

Tonnage upon the Indus.

Boats, ...	Kurwars from									No. of Boats.	Remarks.
	100	80	70	60	50	40	30	20	10		
	90	80	70	60	54	40	40	30	20		
Doondahs	7	33	47	50	70	70	100	100	150	627	Between the Sea and Bukkur.
Doondahs	0	0	0	0	0	0	0	11	0	11	Bukkur and Mittun.
Tohruks,	0	0	0	0	0	0	60	0	0	60	
Tohruks,	0	0	0	0	0	0	0	107	0	107	Mittun and Kalabagh.
Duggahs,	0	0	0	0	0	0	10	0	0	10	
Duggahs,	0	0	0	0	0	0	0	46	0	46	Kalabagh and Attock.
Total,	7	33	47	50	70	70	170	264	150	861	

Abstract.

Upon the Lower Indus are 627 boats carrying 25,530 Kurwars.

Do. Upper do. 188 do. do. 6,550 do.

Do. Attock, 46 do. do. 1,150 do.

Total, 861 33,230

Deduct for old and worn-out 161 5,635

Boats, 700 carrying 27,595 do.

Available between the Sea and Attock, in which neither fishing craft nor the boats of the Punjab rivers are included.

TABLE No. 8.

Price of Boats at Pind Dadur Khan.

A Tohruk, cedar built, of 100 mds. costs 100 Nanukshakee Rupees.			
do.	200	do. 200 225	do.
do.	300	do. 300	do.
do.	400	do. 350	do.
do.	500	do. 450	do.
do.	600	do. 475	do.
do.	700	do. 500	do.
do.	800	do. 500—600	do.
do.	900	do. 600—700	do.
do.	1,000	do. 700—800	do.

TABLE No. 9.

Hire of Boats.

On the Lower Indus Doondahs of 16 Kurwars $1\frac{3}{4}$ Korah Rs. per diem.

do.	do.	35	do.	$3\frac{1}{2}$	do.	do.
do.	do.	40	do.	$3\frac{1}{2}$	do.	do.
do.	do.	38	do.	$3\frac{1}{2}$	do.	do.
do.	do.	60	do.	$4\frac{1}{2}$	do.	do.

On the Upper Indus, Tohruks of 100 mds. at 10 Rs. Goondah per month.

Ditto ditto 700 ditto 60 ditto ditto.

And in the same proportion for Boats of a greater or less burden.

Note.

The Nanukshakee and Bombay Rupee are all equal. Goonda is one anna short of the Nanukshakee.

127 Korah=100 Rupees Bombay.

18 Mamads=1 Kurwar.

A Sketch of the Second Silver Plate found at Badakhshân. By ALEXANDER CUNNINGHAM, ESQ.

In the seventh volume of the *Journal of the Asiatic Society*, at page 1047, was published a sketch of an ancient silver plate, obtained by the late Dr. Lord in Badakhshân. In a letter to me, enclosing a drawing of a second silver plate, which he had fortunately obtained, he mentioned a fact regarding the first plate which is worth preserving; namely, that it "had been an heir-loom in the family of the Meers of Badakhshân, who claim to be the descendants of Alexander the Great; and it had been sold by them in their distress, when they were conquered and imprisoned by Meer Morad Beg of Kunduz, to Atma Ram, his Dêwân Beghi."

Regarding the second plate, I cannot do better than quote Dr. Lord's own words: "I was aware there was a second *patera*, but I failed in all my attempts to get it when I was before in the country. I have now however succeeded; but find, to my astonishment, that its subject is not Grecian, but pure Persian; probably Shápûr killing a lion, as seen in the Persepolitan figures. The *patera* is pure silver; weight 104 kaldâr rupees, (312 drs.) the workmanship of unequal merit; the heads of both man and horse, particularly the latter, appear to me far superior to the other parts; you will notice the peculiar way in which the horse's tail is tied up."

I can add nothing to Dr. Lord's description, except that the original silver plate is 11·2 inches in diameter; and that there is a short inscription of dotted letters on the back of the plates; which appear to me to resemble very closely the Pehlvi characters of the Sassanian coins.

Dotted inscription on the back of Dr. Lord's plate. For the *facsimile* copy of this inscription, I am indebted to the kindness of Lady Sale.



In the four corners of the sketch, I have represented four coins, illustrative of the subject on the silver plate.

No. 2 is the obverse of a silver Sassanian coin, published in the *Journal of the Asiatic Society*, vol. vi. 14, fig. 1, by Mr. Prinsep,



Original 112 inches in diameter.

from his own cabinet. The king's crescent head-dress is the same as that on the silver plate; and the position of the right arm seems to indicate, that it must have pointed a spear towards the indistinct object which is seen between the horse's fore legs, and which is probably the lion of the plate.

No. 3 is the reverse of an early Mahomedan copper coin, published by Mr. James Prinsep, as fig. 2, pl. 14, vol. vi, of his Journal. The obverse has a head and some illegible letters. I have lately procured a similar copper coin, on which the horseman faces to the right; on the obverse is an inscription in ornamental Cufic characters, "*Us sultan ul azem Ala-ud-dunya wa ud dîn;*" and above the horseman on the reverse are the remains of the letters of the name; and between the horse's legs is the word *بامیان* *Bâmiân*, the place of coinage. I suppose this coin to belong to Ala-ud-din Husên, Ghori, who was called the Incendiary, after having mercilessly destroyed Ghazni, and put an end to the Ghaznvide dynasty.* The horseman I believe to have been copied from the coins of the Hindu kings of Lahore, of which No. 5 in the lower corner to the right is a silver specimen of Syâlapati Deva.

No. 4, in the left lower corner, is a gold coin of one of the later Guptas, on which the subject is the same as that represented on the plate; the only difference being that on the coin the horseman is using a sword instead of a lance. This coin may date about A. D. 500. The earlier coins of the Gupta family also display the same subject; but on them the lion is attacked by a bowman on foot; and on the reverse, the goddess Lakshmi is seen sitting upon the vanquished animal.

The subject represented on the plate, and on the coins of the Guptas, is then substantially the same; namely, a hero-king overcoming a

* A large hoard of the Indian gold coins of his nephew, the celebrated Mahomed Ghori, the first Mahomedan king of India, has lately been found in the Huzâra country. About one-fourth of the gold coins are of "*Sri-man Kumâra Pala Deva*"—the remaining three-fourths being of Mahomed Ghori. They are highly curious, as proving that the Musulman conqueror was content to have his name only represented on the coinage of the country, without changing the Brahmanical character of the coin. On the obverse is the seated figure of Durga, and on the reverse, in Deva Nagari characters, is the legend, "*Sri Mahajidina Mahamada Sâma*," for Sri Moaz-ad-din Mahummud Sâma.

lion. The Guptas besides, were contemporary with the most flourishing period of the Sassanian monarchy, from A. D. 350 to 500, and even an interchange of presents took place between them and the Sassanian kings; but which however both parties mention as tribute.

But the coincidence of subject on the coins of the Guptas and Sassanians becomes more striking, when we see that the sculptures, gems, and coins of the latter represent the lion being attacked by a hero on foot. A gem published by Ouseley in the *Oriental Collections*, represents the Sassanian king Balash, or Balasces, on horseback, exactly in the same way in which the kings Chandra Gupta and Kumara Gupta Mahendra are represented upon the Indian coins. But the most curious circumstance is, that we can trace this same horseman from his first appearance on the coins of the Bactrian king Mayas,* (whom I confidently hope to be able to identify with Demetrius, the son of Euthydemus,) through the coins of Azas and Azilisas, Undopherras, and Abalgasus, down to the Indo-Parthian king Arsaces; and then through the Sassanian sculptures, gems, and coins, and through the coins of the Hindoo Guptas of Kanoj, and the Pâla family of Lahôr, down through the Mahomedan coinage of the Ghaznivides, and through the Pathan coinage of India, to the time of Mahmud, the cotemporary of Timur; or from B. C. 200 to A. D. 1400, for a period of 1600 years. All this I undertake to make good, when I shall publish my account of the native coinages of India.

ALEXANDER CUNNINGHAM.

Lucknow, 25th June, 1841.

* I beg to refer my readers to a paper in No. 96 of the Asiatic Society's Journal, in which the identification of Mayas with Demetrius was first maintained in opposition to the theory of Mons. Raoul-Rochette, and others. My friend Lieut. Cunningham has, I am gratified to find, adopted my views, as stated in the paper above noted; views however which he is infinitely better qualified than myself to maintain by sound historical argument.

Note by Captain HAY, on a Bird, native of the Eastern Islands, undescribed (?) in a Letter to the Editor.

Kurnaul, June 7, 1841.

MY DEAR SIR,—If the following account of an extraordinary bird met with among the Eastern Islands may prove new and interesting, you will probably insert the following in your Journal: if otherwise, destroy the communication. It is as far as I can see a new genus, but distant as I am from books, or the means of access to new discoveries, and not being in communication with Mr. Swainson, what I insert is with diffidence.

I can hardly describe the colours of this bird better than by saying, it partakes of precisely the same met with in that well-known and beautiful moth, the Bombyx Atlas, upon which insect it is supposed to feed; and it is not improbable, for their localities are the same, and it will be seen how admirably adapted for a trap is its mouth.

On first obtaining this very extraordinary bird, I commenced examining the generic distinction of "*Eurylaimus*," to which at first sight it appeared to be most likely allied. The *sombre* colours, together with its enormous bristles, seemed to point it out as a night-feeder, and sent me to hunt amongst the "*Caprimulgidæ*;" but with the assistance of Swainson's Birds, 2 vols. in the Cabinet Cyclopædia, and of Vol. x. of the Naturalist's Library, I have not been able to discover any named genus, to which this very extraordinary, and I imagine very rare, bird belongs.

I have apparently two species, if they be not male and female; the length of one however being $16\frac{1}{2}$ inches, whilst the other is not above nine; and the larger coming from Sumatra, whilst the smaller was procured from Malacca, lead me to believe them different species of the same genus.

General colour of plumage, different shades of chestnut and rufous brown, or ferruginous. Wing coverts dark chestnut, tipped with angular white spots, shaded at the edges with black: the larger wing coverts are tipped with black spots, the white edging being scarcely visible; the neck has a collar (resembling a pendent crest from the back of the head) of similarly marked feathers, though less distinct. Whole of the

belly, and beneath wing and tail, pale ferruginous ; throat and breast somewhat darker, and speckled with white : wings and tail ferruginous and barred.

Total length of bird $16\frac{1}{2}$ inches. The bill measures $2\frac{3}{4}$ inches, is wider than the head, and shaped much the same as in *Eurylaimus* ; colour of bill dark red, edged with yellow : the upper mandible overlaps the lower, and has a very sharp edge ; bill strong, but not thick in proportion to that of *Eurylaimus*. Nares so small as to be scarcely visible, and so flat that the point of a penknife cannot easily be introduced ; not basal and round as in *Eurylaimus*, but longitudinal, and covered by long bristled feathers lying along and over its extremely hooked bill ; similar feathers cover the bill to its base, and then recline ; width of bill at base $2\frac{1}{4}$ inches. The eyes are not furnished with lashes above. Wings long and rounded, the sixth quill the longest and tipped with black. Tail 6 inches. Tarsus feathered and long, ventral feathers entirely hide the feet, which are moderately strong, having the inner edge of the nails lengthened and somewhat flattened, middle toe the longest.

This is without exception one of the most extraordinary birds I have ever seen, and I do not remember it to be noticed by Dr. Horsfield. The nares being so different from the broad bills, and the supposition being, that it rests upon branches to receive and devour that immense moth, the "*Bombyx Atlas*," I would propose, should it be a new genus, naming it "*Bombycistoma* ;" or should a more experienced naturalist discover a genus already named, the specific name I would call "*Bombycivoras*." If however it is as I believe entirely new, I would name it "*Bombycistomas Fullertonii*," after the late Governor of Prince of Wales' Island, whose kindness first led me to visit the Eastern Isles, and where I first imbibed my taste for Ornithology.

In describing this bird I have before me, specimens of the genera "*Eurylaimus*," "*Cymbirynchus*," and "*Psarisomus*."

The second species which I have above mentioned, has a less brilliant plumage, and length only 9 inches. Bill $1\frac{1}{2}$ inches in width, similar to the former, but the bristles covering the nares are less prominent ; wings not so lengthened ; belly of a much lighter colour ; and the beautiful white and black spots so conspicuous on the larger bird here scarcely attract the eye.

A third bird procured by me at Malacca would appear to unite the bird first described with *Eurylaimus* ; the bill in shape and form is the same, but wanting the stiff bristles ; the legs are also much stronger, nails differently formed, and tarsus naked. As this is also a rare bird, I will describe it as well as I am able. Extreme length 11 inches. Bill $1\frac{1}{4}$ inches in width ; culmen more arched than in the former, or than in either of the genera above named ; eyes unprotected. Nares basal and round, colour bluish black, throat and upper part of breast dirty ochre. A white bar under both wings and tail. This possibly may have been described, but I think not. These Broadbills are a very interesting series of birds ; the most dull in colour is that last described, and by far the most beautiful, the "*Psarisomus Dalhousiæ*" of Swainson, which rare bird I have been so fortunate as to procure.

My desire is to make, what I consider a new bird known ; not to claim a name, which after all may be considered inappropriate, and would then be passed over by Naturalists, "as if it never had existed."

It appears to me, that this will be the typical character of the Broadbills instead of *Eurylaimus*, in which case its name will be changed by Swainson, under whose observation I hope this bird may come.

The enclosed very rough sketch will serve to give some idea of the appearance of the head or bill, and if it prove new, it may be interesting to your Ornithological readers.



Examination of some decayed Oriental Works in the Library of the Asiatic Society. By H. PIDDINGTON, ESQ. Officiating Curator, Museum Asiatic Society.

At the request of our Secretary, I have undertaken the chemical examination of the decaying Oriental MSS. Works in the Society's Library, of which the following is a description :—

It is found that, principally in the Arabic books, at the end of a certain time, a shade of black is observable about the letters. This gradually appears to increase to a cloud round each word, such as would be produced by a light shading of Indian ink. It increases to a decided brown, and eventually a black colour, when the leaves become wholly decomposed in the middle, where the black is most intense, and fall to pieces like tinder, (the writing still remaining quite visible upon them,) so that they crumble under the fingers; and in short resemble, in those parts, books which have been burnt in close vessels; reminding us of the descriptions we read of the MSS. of Herculanæum and Pompeii. In some places, where the page is surrounded with an ornamental border of red and black lines, the black line appears so completely to have destroyed the paper, that the page may be almost taken out, as if it had been cut round with a penknife. The Moulvees said it was owing to the "*kuth*," (catechu,) but the effect seemed a very unlikely one to be produced by an astringent. The disease, however, evidently arises from the ink; the paper where not written upon, being in good preservation where it has not spread from the writing.

To discover what can have produced this very serious mischief, was the problem to be solved.

1. The smell of the carbonised parts was something approaching to that of caramel; the taste sharp, saline, and acid, but not caustic.

2. A quantity of the tinder-like matter from the centre of a book, equal to about half an octavo page, was boiled in distilled water. The solution was of a dark clear red-brown colour, it reddened litmus paper very sensibly; there was therefore free acid, and no free alkali present.

3. The presence or absence of the following substances were shewn by their corresponding tests as follows :—

Presence of	{	Sulphuric acid	...	...	Acet. Barytes.
		Muriatic acid, (trace,)	...	...	Nit. Silver.
		Potass,	...	...	Mur. Platina.
		Lime, (minute quantity,)	...	...	Oxal. Ammonia.

Absence of	{	Iron,	{	Tinct. Galls.
				Prussiate Potass.
		Copper,		Ammonia.
		Nitric acid,		Mur. Acid and Gold leaf.

4. The solution being evaporated, a portion of the carbonaceous matter became insoluble. Cold alcohol did not act on the gummy mass left, nor was any soluble salt obtained by it.

5. Acetate of barytes was added to the clear solution, and the precipitate dried at a low red heat, weighed 2.25 grs. which would give 0.75 grs. of sulphuric acid for each half, leaf or 450 grs. (by weight) for a volume of 300 pages. This is of course but an approximative calculation; but we may be fully satisfied by it, that the quantity of free sulphuric acid in the book, is quite sufficient to produce the mischief.

6. This decomposition of paper, so as to crumble to pieces between the fingers, (though without being much discoloured,) is familiar to every chemist, as happening daily to the edges of his filters with acid and alkaline solutions of but moderate strength. The discolouration may arise from the ink and iron carried by capillary attraction through the fibres of the paper with the acid, or finally, since the ink remains unaltered in most parts, from the carbonisation of the paper.

7. I suppose the excess of acid to have arisen from the use of an excess of crude sulphate of iron (*heerakosh*) in the ink, which, either ignorantly or by design,* is added in too large quantities, and thus an extra portion of sulphate of iron, in addition to the sulphuric acid set free in the composition of ordinary inks, remains in it. Sulphate of iron is a sulphate of the protoxide of iron, and the vegetable matter of the paper being particularly prone to combine with both the acid and the iron, of which last the common iron-mould spots are such familiar examples; it may easily be supposed, that in our humid climate, with its high temperature, new chemical combinations must soon take place amongst the varied principles of paper and ink-starch: gum, vegetable fibre, gallic and sulphuric acids, iron, lime, and potass; of which, as we see, the result is, that the carbonaceous matter of the paper alone remains. An analogous effect is observed by mineralogists upon labels or wrapping papers, when, by the decomposition of pyrites, sul-

* By design. There are secrets in all trades, and our Moulvee informs me, that the copyists of "*Arabisthan*" well know that their books will not last *too* long, and so spoil trade.

phate of iron is formed in specimens. The specimen upon the table is an instance where this has gone on, and at the contact of the decomposed pyrites, the label is exactly reduced to the state of our books. Another effect, perhaps of this kind, is the discolouration of the leaves of books printed upon ordinary paper, in the making of which, it is said, gypsum is used in considerable quantities to increase the weight. In this case, as gypsum has a tendency to decomposition when in contact with vegetable matter, the sulphuric acid may also be set free? The paper of these books becomes brownish, brittle, and finally crumbles to pieces, so that it is called "the dry rot."

The practical inference to be drawn from all this, for our use and that of other Societies and collectors, is, I think, this; that in copying MSS. we must prohibit the use of mineral inks—being never certain of their composition—and employ only China ink, which with a little trouble, is well adapted for fine Oriental writing. This being pure sepia or carbonaceous matter, will probably be as lasting as the best paper. I have moreover recommended, that all paper used for copying in the Library, should be well soaked in a solution of alum, which will take off the excess of starchy and gummy matter in the size, and perfectly secure it against damp; for paper so prepared is crisp in the dampest weather, and no insect will touch it. I should thus hope our MSS. will be placed in safety for a long period; but I should urge on the Society the prudence of securing copies of all the rare works, in which this discolouration has begun. There is another practical inference, which I also take leave to suggest, and it is the following: May there not be a great mass of Government records, subject to this cause of decay, through the use of ill-made ink?

Museum, 26th June, 1841.

H. PIDDINGTON.

NOTE.—This valuable memorandum was prepared by Mr. Piddington, on my shewing him a copy of the "*Murrat ool Jinan*," which had been completely destroyed by the process above remarked on. The MS. is from Egypt, and copies of it very rare. Alarmed at the destructive process to which other valuable MSS. in the Library of the Asiatic Society were subjected by similar decomposition, I at once set copyists to work to make duplicates of all which shewed signs of decay, profiting by the suggestions offered in this paper, for prevention of the injurious effects of bad ink and paper. I may add, that I have procured from Lucnow a copy of the lost MS. which is in course of transcription.

On Bos Gaurus. By W. ELLIOT, Esq. M. C. S. (from the *Madras Journal of Literature and Science.*)

The notice of the Bovine Genera by Mr. Hodgson of Nepal, published in No. 114, and the observations on *Bos Gaurus* by that able naturalist and by Dr. Spilsbury, which have already appeared in this Journal, may be well followed up by an extract from Mr. Walter Elliot's (Madras Civil Service) "Catalogue of the Mammalia in the southern Mahratta country," describing the animal above named, with reference to an article by Mr. Hodgson on the same subject in the 6th vol. of this Journal. One or two short notes have been appended by Mr. Hodgson to Mr. Elliot's paper, which appear with this reprint of it. By thus borrowing Mr. Elliot's excellent paper from the *Madras Journal of Literature and Science*, I shall have been enabled to unite with and submit to my readers all that intelligent naturalists in various parts of India have observed and recorded regarding one of the most remarkable of Indian quadrupeds "indicated distinctly," says Mr. Elliot, writing in 1840, "only within the last two years," and doubly remarkable from its apparent identity with the extinct species, fossil remains of which have been exhumed in Europe.

It may be worth while to quote a curious notice, one of the earliest, if not the earliest, by any English writer, of the *Bos Gaurus*, from the narrative of his captivity in Candy by Capt. Knox, (A. D. 1673,) who resided 19 years in the country: I met casually with it, and do not know but that it may have been quoted before. The writer is however so correct, and sagacious an observer, that I venture to incur the risk of repetition in order to supply testimony to the existence of the *Bos Gaurus* in Ceylon at the time of his confinement there.

(Knox's Historical relation of Ceylon, Chapter VI.) "Here are also wild buffaloes; also a sort of beast they call *gauvera*, so much resembling a bull, that I think it one of that kind: his back stands up with a sharp ridge; all his four feet white up half his legs. I never saw but one, which was kept among the King's creatures."



58.—*Bos (Bibos) Cavifrons*, Hodgson—*Journal Asiatic Society Bengal*, vol. VI. (1837) pp. 223, 499, 745.

Bos Gaurus, Griffiths.—*Gour*, Geoff.

Kar kona, Canarese.

Jungli khoolga, Dekhani.

Gaviya, Mahratta.

It is somewhat remarkable that one of the largest animals of the Indian Fauna, frequenting all the extensive forest tracts from Cape Co-

morin to the Himalayas, should only have been indicated distinctly, within the last two years. I have seen specimens from Tinnevely, and likewise from the whole range of the Syhadree mountains up to Mahableshwar, and I know that the animal has been killed near Vellore, in the Sherwaroyah hills near Salem, at Aseergurh, in Kandes, Rajamundry, and I doubt not that it will likewise be found in all the deeper recesses of the eastern Ghauts, and on the banks of all the great rivers passing through them. An imperfect cranium, which seems to belong to a female of this species, in the United Service Museum, is labelled thus "Head of a Bison from Kuddah, Straits of Malacca, presented by Lieutenant-Colonel Frith, Madras Artillery."

The following memoranda were made in 1833 in the southern Mahratta country, at a time when I had frequent opportunities of seeing the animal. "It is called *Gaviya* by the Mahrattas, *Jungli khoolga* and *Urna* by the Mahommedans, (though it has not the slightest affinity with the buffalo, to which both of these names apply), and *Karkona* by the Canarese, which is of similar import, from *Kadu*, a forest, and *Kona*, a buffalo.

It differs also very remarkably from the common ox, and though it approaches considerably more to the descriptions of the bison, the name generally applied to it by English sportsmen, it exhibits marked structural differences, excluding it from the Bisontine group as defined by Cuvier. These consist in the plane of the fore-head being "flat and even slightly concave," and in the possession of only 13 pair of ribs. It is not improbable that it will be found to constitute a connecting link between the Bisontine* and Taurine groups. The most remarkable characters in the animal are an arched coronal, or convex bony ridge, surmounting the frontal bone, and projecting beyond it so as to make the line from the vertex to the orbit a concave sweep; the continuation of which from the orbit to the muzzle is slightly convex. The other distinctive mark is the prolongation of the spinous processes of the vertebræ of the back, from the withers to the loins where they cease abruptly. These processes are 12† in number, and their prolongation gives the animal a very extraordinary appearance.

* One prime character of skull is enormous massiveness, three times that of the Ox's skull.—B. H. H.

† 13, or same as the ribs.—B. H. H.

The largest individual I met with, was killed in an island of the Kala Nuddee in the district of Soonda, in 1827. A noted shikaree, the Potel or headman of Alloor (a Hubshee or negro descendant of some of the numerous African slaves imported in the 15th century by the Mahommedan kings of Beejapoor, and who still exist as a distinct race, in this district,) called us at day-light, and promised to shew us one of the animals described by him as a wild buffalo. Crossing the river in a canoe, we struck into the forest and soon came upon a track which he pronounced to be that of a large bull. On this he proceeded with the steadiness and sagacity of a blood-hound, though it was often imperceptible to our eyes. At times when a doubt caused us to stop, he made a cast round, and on recovering the track summoned us to proceed by a loud whistle, or by imitating the cry of the spotted deer, for not a word was spoken, and the most perfect silence was enjoined. As we advanced he pointed silently to the broken boughs or other marks of the passage of a large animal, and occasionally thrust his foot into the recent dung, judging by its warmth of the vicinity of the game. We followed his steps for three miles to the river, then along the banks towards Dandelly, where the animal appeared to have passed to the other side. Wading across, we ascended the bank of a small island covered with thick underwood, and some large trees, amongst which it had lain down, about fifteen yards from where we stood. The jungle was so thick that we found it difficult to distinguish more than a great black mass among the underwood. On firing the animal got on his legs, received two balls more, and rushed into the jungle where he became very furious, and we were obliged to shelter ourselves behind the trees, to avoid the repeated charges he made, though one ball through the shoulder which had broken the bone above the elbow, prevented his moving with facility. He then became exhausted and lay down, snorting loudly and rising to charge when any one approached. A ball in the forehead caused him to roll over the precipitous bank into the river. Still however he was not dead, and several balls were fired into his forehead behind his ear and the junction of the head and neck without life becoming extinct; one ball which had struck the vertebræ of the neck was taken out almost pulverized.

When drawn ashore and examined more minutely, the first sentiment produced in all present, was astonishment at his immense bulk and

size; but on measuring his height we found him much taller than his breadth at first led us to imagine.

The head is very square, and shorter than in the common ox, the forehead ample, the bony ridge rising about five inches in height from the plane of the frontal bone over which it inclines. When viewed behind it rises suddenly and abruptly from the nape of the neck, from whence to the vertex it measures seven inches, the horns make a wide sweep, in continuation of the arched bony ridge, and turn slightly backwards and upwards, forming an angle of about 35° with the frontal bone, the whole of the head in front, above the eyes, is covered with a coat of close short hair of a light greyish brown colour which below the eyes is darker, approaching almost to black. The *muzzle is large and full*,* of a greyish colour, the eyes are smaller than in the ox, with a fuller pupil of a pale blue colour, the ears are smaller in proportion than in the ox, the tongue is very rough and covered with prickles, the neck is short, thick, and heavy, the chest broad, the shoulder very deep and muscular, the forelegs short, the joints very short and strong, the arm exceedingly large and muscular. Behind the neck and immediately above the shoulder rises a *fleshy gibbosity* (?) or hump, the same height as the dorsal ridge, which is thinner and firmer, *rising gradually as it goes backwards*,† and terminates suddenly about the middle of the back. The hind quarters are lighter and lower than the fore, falling suddenly from the termination of the ridge, the tail very short, the tuft only reaching down to the hocks.

The dimensions of this individual were carefully noted as follows:—

	feet inches.	
Height at the shoulder.....	6	$1\frac{1}{2}$
Do. at the rump (taken from hoof to insertion of tail).	5	5
Length from the nose to the insertion of the tail.	9	$6\frac{1}{2}$
Do. do. to the end of the tail which was 2 ft. 10 in.	12	$4\frac{1}{2}$
Do. of dorsal ridge including the hump.	3	4
Height of do. do.	0	$4\frac{1}{2}$
Girth (taken behind the forelegs)	8	0
Breadth of the forehead	1	$3\frac{1}{2}$

* Less than in *Bos* or *Bubalus*.—B. H. H.

† Quere forwards? The height of the true dorsal ridge declines from the third process of the vertebræ, and the general appearance of the ridge therefore is a declination, not a rise, towards the croup from the withers.—B. H. H.

From the muzzle to the top of the arched bony ridge ...	2	1 $\frac{3}{4}$
Distance between the points of the horns	2	1
Circumference of horn at base	1	7 $\frac{1}{2}$
Between the roots of horns.....	0	13 $\frac{1}{2}$
Length of the ear	0	10 $\frac{1}{2}$
Circumference of the neck	4	4
Depth of the shoulder (from the elbow to the end of the spinal ridge) ..	1	2 $\frac{1}{2}$
From the elbow to the knee (i. e. the fore-arm) ..	4	5 $\frac{3}{4}$
From the elbow to the heel	2	7
Circumference of the arm	2	6

The skin on the neck and shoulders and on the thighs is very thick, being about two inches in this one, which has already shrunk from lying in the sun. It is used for making shields, which are much prized. On examining the skeleton picked clean by the vultures, we could only distinguish thirteen pair of ribs.

The cows differ from the male in having a slighter and more graceful head, slender neck, no hump, a less defined dew-lap, and the points of the horns do not turn towards each other at the points, but bend slightly backwards; the horns are smaller too, and the frontal bone narrower, but the coronal or ridge is distinctly marked. The bulls have the forehead broader in proportion to their age. In the young bull it is narrower than in the cow, and the bony ridge scarcely perceptible. The horns too in the young specimen turn more upwards.

The general colour is dark brown, the hair thick and short, but in old individuals the upper parts are often rather bare. That on the neck and breast and beneath is longer, the skin of the throat is somewhat loose, giving the appearance of a slight dew-lap. The legs are white, with a rufous tint on the back and side of the forelegs. The skin of the under parts when uncovered, is a deep ochry yellow. The cow has the legs of a purer white.

The breeding season is said to be early in the year, and the calves are born after the rains. The bulls are often found separate from the herd, which consists generally of from ten to fifteen cows and a bull. They generally feed during the night, browsing on the young grass and the tender shoots of the bamboos, of which they are very fond. In the

morning they retire to some thicket of long grass, or young bamboos, where they lie down to ruminate. When disturbed the first that perceives the intruder stamps loudly with its foot to alarm the rest, and the whole rush through the forest, breaking down every obstacle, and forcing their way with a terrific crash,

————— dat euntibus ingens

Silva locum, et magno cedunt virgulta fragore.

Æn. vii. 676.

When suddenly approached in the night, they start off with a loud hissing snort.

In 1831, I saw a young Bison calf in the possession of some Gówlees, the owners of large herds of buffaloes in the Hangul talook. It was caught when just dropt, in the month of May, and when I saw it, was seven months old, very tame and gentle, though timid, licking the hands of the Gowlees, and frisking about with the buffalo calves. It was the same colour as the old animal, very dark brown with white legs. The head small, the forehead wanting the breadth so remarkable in the adult, and the bony ridge of the crown was hardly perceptible. The horns were just beginning to sprout, the ears larger and rounder than those of the buffalo, the eyes a pale grey or cerulean colour. The hair on the throat was long, and the dew-lap slightly indicated. No hump was perceptible, but the dorsal ridge was distinctly marked.

The Gowlees say, they see great numbers of Bison when pasturing their herds in the neighbouring forest. They describe them as very timid and watchful, more so than any other wild animal, always reposing in a circle with their heads turned outside, ready to take alarm. They add, that they see most calves from June to October, but the greatest number about August. They do not know how long the cow goes with calf, but suppose the period of gestation to be the same as that of the buffalo, or ten months and ten days. The old male drives the others from the herd at the breeding season, and the single ones seen in the jungle are young males of this description, and it is probable the very old bulls are sometimes expelled also by younger and stronger males."

For the following particulars derived from the observation of the animal in the Shervaroyah hills, I am indebted to Mr. Fischer, of Salem: "The Bison ordinarily frequents the hills, seeking the highest and coolest parts, but during the hottest weather, and when the hills are parched

by the heat, or the grass consumed by fire, the single families, in which they commonly range the hills, congregate into large herds, and strike deep into the great woods and valleys; but after the first showers, and when verdure begins to re-appear, they again disperse, and range about freely. In wet and windy weather, they again resort to the valleys, to escape its inclemency, and also to avoid a species of fly or gnat, which harasses them greatly. In the months of July and August, they regularly descend to the plains, for the purpose of licking the earth impregnated with natron or soda, which seems as essential to their well-doing, as common salt is to the domestic animal when kept in hilly tracts.

The chief food of the Bison seems to be the following grasses and plants:—

Yadanjān cody

Vallaum pilloo *A species of Sacharum, used for thatch.*

Odeserengan pilloo

The cottay woottoo leaf *Ricinus Communis, Castor oil Plant.*

Mullum pilloo *Anthystiria polystachia, Roxb.*

Canavum pilloo *Sorghum muticum. Wild Cholum.*

Cheevum pilloo *Broom grass. (Aristida).*

Cattoo Corangan leaf *A species of Convolvulus. Ipomœa Staphylina?*

but they will eat with avidity every species of grain commonly cultivated on the hills or plains, as the ryots find to their cost. The Bison particularly is so fond of the *avaray cottay* (*Dolichos Lablab*, Ainslie),* when in blossom, that they will invade, and destroy fields of it, in open daylight, in despite of any resistance the villagers can offer. In other respects it is a very inoffensive animal, very rarely attacking any one it encounters, except in the case of a single bull driven from the herd. Such a one has occasionally been known to take up his location in some deep bowery jungle, and deliberately quarter himself on the cultivation of the adjacent villages. The villagers though ready to assist Europeans in the slaughter of Bison, will not themselves destroy them (the inviolability of the cow extending to the Bison); and so bold does this freebooting animal become in consequence, that he has been known to drive the ryots from the fields, and deliberately devour the

* Country bean.

produce. But in general it is a timid animal, and it is often difficult to get within gun-shot of them.

The period of gestation is with the Bison the same as with the domesticated animal; they drop their young in the months of September and October. I once had one brought to me so young, the navel string was still unseparated. I should think it was then about the size of a common country cow's calf of four months old. It seems a slow growing animal. A calf I had for three years was evidently in every respect still a mere calf. They seem very difficult to rear. I have known it attempted at different ages, but never knew the animal to live beyond the third year. Mr. Cockburn has tried it in vain, in its native climate, the Sherwaroyah hills, and I have made the attempt at Salem repeatedly. At one time I had five in my farm-yard; one lived for three years: but this one, with all the others, died suddenly in the same week from some disease, marked by refusal of food, running from the nose, and an abominable stench from the mouth. A similar disease, it may be noted, prevailed, I was informed, at the same time, among the Bison of the Sherwaroyah, Shandamungalum and Neilgherry hills. The calves I had, never became in any degree domesticated: the domesticated cow could never be induced to suckle them."

I may add, that the persevering ferocity of the Bison of the Sub-Himalayan range, described by Mr. Hodgson, is quite foreign to the character of the animal in the southern forests. When wounded, it is true, it charges its assailant with determined courage, and many instances have come to my knowledge of its doing so with fatal effect, among which I may cite those of two officers within the last few years, both of whom were killed at the Mahabaleshwar hills; but in general it will always seek its safety by flight, if permitted.

	inches.
Height from the end of the maxillary bone to the vertex...	22
Breadth of front between the edges of the horns.....	13 to 14
Length of horn from base to point in a straight line	21
Do. do. along the curve ..	30
Diameter (longest section) inside	6 $\frac{1}{2}$
Do. (broadest do.).....	4 $\frac{3}{4}$
Circumference at the base.....	18 $\frac{1}{2}$
Distance between the points.....	39

Proceedings of a Special Meeting held at the Asiatic Society's Rooms.
(Friday, 14th May, 1841.)

The Hon'ble W. W. Bird, Esq. in the Chair.

Read the following letters ; viz.

From Mr. A. Csoma de Korosi of the 1st May 1841, tendering to resign the office of Librarian to the Asiatic Society of Bengal, and requesting permission to occupy his present quarters in the Asiatic Society's premises till the period of his departure from Calcutta. Also offering for the acceptance of the Society "the half of his salary" received by him during the three years of his employment as the Society's Librarian.

From Mr. Secretary Bushby, No. 309, dated the 7th April 1841, communicating copy of a letter from the Hon'ble the Court of Directors, advising that they had sanctioned the payment of an advance of £150 to Mr. E. Blythe, selected by Professor Wilson as Curator of the Museum of the Society, for his outfit and passage, and requesting information as to the mode most agreeable to the Society to refund the advance made to Mr. Blythe by the Court.

On the foregoing, it was resolved—

That the Committee recommend that the resignation of Mr. Csoma de Korosi be accepted, with the expression of the acknowledgments of the Society ;—That the Society do not accept the refund of the half salary for three years ;—That the Society with reference to the continued connection with Mr. C. de Korosi accede to placing him on the same footing as he was before he became Librarian, and permit him to remain in the rooms he now occupies till his departure.

That the Committee recommend the Society to employ a Librarian on 100 Rupees per mensem, and suggest that candidates be invited to submit their application,—the Secretary in the mean time, taking on himself the charge of the Library.

That the invitation be conceived in the following terms:—"The Society beg to state that no candidate need apply who is not a man of education and of literary habits, more or less acquainted with Oriental languages, and who is not prepared to attend in the Library for not less than four hours a day."

The question of re-payment of the advance to Mr. Blythe for outfit made by the Court of Directors being laid before the Committee, it was resolved—That the subject be left in abeyance till his arrival.

With reference to the foregoing Resolutions, the following letters to Mr. Csoma de Korosi and to Mr. Secretary Bushby were addressed, and a "Notice" published in the daily papers under this date.

'To Mr. A. CSOMA DE KOROSI,'

Librarian.

'SIR,—Having submitted to the Committee of Papers of the Asiatic Society your letter dated the 1st instant, tendering your resignation as its Librarian, with

liberty to retain your present quarters till the period of your departure from Calcutta, as also the offer of half the salary received by you during the three years of your employment, I am desirous to state that, although the Society accepts your resignation, with the expression of its acknowledgments for your valuable services, yet it cannot accept your offer of the refund of "the half salary for three years;" but your motives for making it are duly appreciated.

2. With reference to the continued connection with yourself and the Society, the Committee of Papers accedes to placing you on the same footing as you were before you became Librarian, *i. e.* to receive an allowance from the Society of Rupees 50 per month, with permission to retain, till your departure from Calcutta, the rooms now occupied by you.

3. The foregoing arrangements to have effect from the 15th instant.

I am &c.

(Signed) H. TORRENS,
Secretary Asiatic Society.

' To G. A. BUSHBY, Esq.

' Secretary to the Government of India.

' Gen. Dept.

' SIR,—I have the honor to acknowledge the receipt of your letter, No. 309, dated the 7th ultimo with its enclosure, and in reply to state for the information of the Right Hon'ble the Governor General of India in Council, that the Asiatic Society would prefer that the consideration by them of the suggestion of the mode of re-funding the advance of £150, for outfit and passage made to Mr. E. Blythe, who has been selected as the Curator of the Society by the Hon'ble the Court of Directors, be left in abeyance till the arrival of that individual.

I have, &c.

(Signed) H. TORRENS,
Secretary Asiatic Society.

NOTICE.

Wanted, a Librarian for the Asiatic Society of Bengal, at a Salary of Rs. 100 per month. No candidate need apply who is not a man of education and of literary habits, more or less acquainted with Oriental languages, and who is not prepared to attend in the Library for not less than four hours a day.

Applications to be submitted addressed to H. Torrens, Secretary Asiatic Society.

Proceedings of the Asiatic Society.

(Wednesday Evening, 7th July, 1841.)

Dr. J. J. HEBERLIN, Senior Member present, in the Chair.

Mr. S. G. T. HEATLY proposed at the Meeting of the 2d June last, was ballotted for and duly elected.

Ordered, that the usual communication of his election be made to Mr. HEATLY, and that he be furnished with a copy of the rules of the Society for his guidance.

Library and Museum.

Books received for the Library of the Asiatic Society, for the Meeting of the 7th July, 1841.

Mantell's Wonders of Geology, London, 1838, 8vo. 2 vols.

The Calcutta Christian Observer, for June and July 1841, New Series, vol. 2d, Nos. 18 and 19.

Lardner's Cabinet Cyclopædia—Swainson and Shuckard's History and Natural arrangement of Insects.

Transactions of the Linnean Society, vol. 16th, part 1st, vol. 17th, part 1, 2, 3, and vol. 18, parts 1, 2, 3, 7 vols.

Calcutta Monthly Journal, &c. for May 1841, 1 vol.

Yarrell's History of British Birds, part 23d.

Annals and Magazine of Natural History, No. 41, March 1841.

Oriental Christian Spectator, Second Series for March, April, and May 1841, Nos. 3, 4, 5, Bombay.

Maha-Nataka, a Dramatic History of King Rama, by Hanumat, translated by Kali Krishna Bahadur, Calcutta, 1840, 1 vol.

Genealogical and other accounts of Maha-Raja Kali Krishna Bahadur, Calcutta, 1841.

Proceedings of the American Philosophical Society, vol. 1st, Nos. 12 and 13 for 1840.

Proceedings of the Linnean Society of London.

Catalogue des Livres composant la Bibliothèque de feu M. Klaproth, Paris, 1839. 1 vol.

Read the following report from Dr. E. ROER, appointed Librarian to the Asiatic Society of Bengal in the room of Mr. CSOMO DE KOROSI, resigned.

H. TORRENS, Esq.

Secretary, Asiatic Society.

Sir,—I have the honor to submit to you the following report:—

Having taken charge of the Library on Monday the 21st of June, I thought it my duty to ascertain the number of the European Books; the number not being specified in the Manuscript Catalogue, and I found it to be the following:—

English Books,	...	...	...	...	2,292
Ditto Pamphlets,	...	...	...	...	211—2,503
French Books,	...	...	...	...	1,140
Ditto Pamphlets,	...	...	...	...	209—1,349
Latin Books,	...	...	...	...	537
Ditto Pamphlets,	...	...	...	...	27—564
Miscellaneous Books,	...	...	...	...	331
Ditto Pamphlets,	...	...	...	...	39—370
Books lent out,	...	...	...	...	205
Ditto Pamphlets ditto,	...	...	...	...	14—219—5005

It is highly satisfactory to me, as it will no doubt be to the Committee, to know that most of the Books belonging to the Society are in good condition. I am, however, sorry to say, that some of the Manuscripts of the Sanscrit and Persian Library are in a state which threatens irreparable loss, if not immediately transcribed.

Of these I forward a list.

The key of the Medal Cabinet having been delivered to me by MR. PIDDINGTON, I counted the medals in the presence of MR. DE KOROS and MR. BOUTCHEZ, and found their number exactly corresponding to that stated in the list, excepting two impressions which were not mentioned in it.

My attention has been directed to the arrangement of the Books and of the Catalogue, and I avail myself of the present opportunity to make a few remarks.

The arrangement of the books is made, I perceive, according to the languages in which they are written, and in each division they are placed according to their size; the same plan is adopted in the Catalogue, with the exception, that the Books instead of being placed according to their size, are arranged after the alphabetical order.

I need not stay to inquire how this arrangement is at variance with a proper classification, as I think this is clearly apparent, I shall merely offer a few remarks concerning it.

As the proper and principal design of the arrangement of a Library is to promote the most extensive and the most beneficial use of the books, no classification which does not approach as near as possible to the natural division of literature in general, can be satisfactory.

An arrangement opposite to the classification of sciences, isolates the use of the books, while a Library, arranged as strictly as possible according to the subjects, suggests at once all that is, and all that is not contained in the collection relating to the different branches of science, and at the same time invites and introduces the inquiring mind into the outer halls of science.

All the large libraries which I have seen are arranged according to this plan, for instance those of Berlin, Goettingen, and Wolfenbuttel.

It is desirable, that this principle should be followed in the arrangement of every library; yet it must be allowed, that it can strictly be adhered to only in large collections which contain the leading works of every branch of learning; it must, however, be borne in mind, that an arrangement according to a well-concerted plan, though not followed out in the minor niceties, is infinitely preferable to an arrangement, based upon a contrary principle.

For a Catalogue there is not, however, the same necessity for such an arrangement. A Catalogue has to state only what books are in a library, and to point them out, so as to be easily and immediately found; the alphabetical order seems to be a sufficient provision.

This arrangement is adopted in the Catalogues of many libraries. There is, however, another purpose in the framing of a Catalogue which should not be forgotten, and that is to inform the man of reading and science, what advantages he may derive from consulting the library. It can scarcely be expected, that such information can be obtained by an alphabetical order. To peruse a Catalogue of a large library to ascertain what works it contains, relating to particular branches of learning, is a waste of time to which few people will submit, and consequently a library may contain many excellent works which have escaped the notice even of literary men, and the Catalogue therefore fails in accomplishing the most important purposes for which it was made.

If the foregoing remarks be correct, a new arrangement of the Library and Catalogue is desirable.

The number of books being 5,000 and upwards, is, I think, sufficiently large to sanction such an arrangement, and as a new Catalogue is now about to be printed, this is perhaps the most favorable time to make it, should the Committee deem it necessary.

Under this impression, I have directed my attention to a proper arrangement of the Library and Catalogue, which might afford the members of the Society the greatest facility in using the books.

I have now the honor to lay the arrangement which I think it desirable to make before the Committee; but I would, however, beg to say the arrangement is based on a Classification of the

subjects, only as far as the deficiencies of the Library will admit, and will afford, if not all, most of the advantages of the above plan.

A.	B.	C.
Classical Literature.	Oriental Literature.	European (modern) Literature.

I. Philosophy.	A Classic Literature.	II. History, &c.	III. General Literature.
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Thus also the Oriental Literature.

C.

European (modern) Literature.

I.—Theology,

II.—Jurisprudence,

III.—Medicine,

IV.—Philosophy,

V.—Mathematics,

VI.—Natural Sciences,

VII.—History (including Diplomacy, Numismatology, Biography, Memoirs, &c.)

VIII.—Geography, Topography, Statistics, &c.

IX.—Travels and Voyages,

X.—General Literature,

XI.—Linguistics, (Dictionaries, Grammars, &c.)

XII.—Proceedings, Records, &c. of Societies, Journals, &c.

XIII.—Encyclopædia Works.

XIV.—Maps.

I have not stated the sub-divisions in the arrangement of the Library, as they must depend upon the number of works in each division.

In the Catalogue each division will be arranged alphabetically, according to the titles; but no sub-divisions will be made; still however, it will be desirable to annex an alphabetical Index of the names of the authors, with reference to the page of the Catalogue in which their works are to be found.

In concluding this Report, I would remark, that I have already completed in Manuscript, the Classical and Oriental sections, and the division of History also in the third section.

Should the Committee approve of the arrangement I recommend, I shall endeavour to complete it as soon as possible.

I have the honor to be, Sir,

Your obedient servant,

E. ROER.

July 1841.

Ordered that the Report be referred to the Committee of Papers for consideration, as regards the adoption of the plan of arrangement and classification of the Books recommended by Dr. ROER.

Read the following Report of the Officiating Curator for the month of June last:—

H. TORRENS, Esq.

Secretary Asiatic Society.

Sir,—For the month of June I have the honor to report as follows:—

“*Geological, Paleontological and Mineralogical Departments.*—Our catalogues and arrangements are continuing. In the Geological department we have obtained a very interesting addition to our collections. In my report to Government on the soils brought from China by Captain HALSTED, and sent to the Museum of Economic Geology, I pointed out that it was matter of much regret that no *rocks* accompanied the soils, from a place where so many curious phenomena had evidently taken place, and were yet going on. The Right Honorable the Governor General has been pleased to interest himself in this matter, and to request Captain HALSTED to favour us with any specimen of the rocks which he might possess, and the result is the very curious series now on

the table; being basaltic hornblende from the central peak, calcareous sandstones and concretions from the raised coasts and adjacent islands, with one or two specimens of indurated clays, and a specimen of what I should almost venture to term a lias limestone! found in boulders about the mouths of the volcanoes. When to this we add the fact that of sixteen specimens of the soils of the island, only two are in any degree calcareous, and these probably from the admixture of shells, we have evidence that the volcanoes have formed the soils by eruptions of mud, either before or since the upheavement of the island, since from the absence of the calcareous matter the soils cannot have been formed like the coast rocks. It would moreover appear, that the eruptions have been from different strata, amongst which one much resembles the lias, so great a novelty in Indian Geology; but which according to FRANKLIN, is found [in the basaltic district of Bundelcund, in the direct line between the mud volcanoes of Cheduba and those of Sommeanee.

Osteological.—We are beginning to mount the skeleton of the Neelghye.

Ornithological and Mammalogical.—Nothing new to report.

Conchological.—Captain HALSTED has obliged us by a small collection of shells from Cheduba and the neighbouring islands, of which some will be additions to our cabinet.

Botanical.—We have also in this department to announce an addition to the development of our knowledge of Indian Natural History. My report for the month of May, and the Paper on the Society's Himalaya Lichens, published in the Journal, anticipated the probability, that we should discover valuable ones in our vast extent of territory; and I have now the pleasure to announce, that one of our own specimens No. 17, which at first gave a brilliant crimson, has now changed to a rich purple, shewing that it is of considerable value as a dying Lichen. The bottle containing the liquid has been placed at the disposal of the Right Honorable the Governor General for transmission to England; and we shall endeavour to procure such a supply of the Lichen, as may enable proper experiments to be made.

Museum of Economic Geology.—DR. ANGUS has been kind enough to procure for us from DR. HUNTER of Futtyghur, specimens of the green glass bottles, and of the mixture used for manufacturing them there, as also of the clay from which the fire bricks are made.

He has also been good enough to promise us larger specimens of the materials from which the frit of the glass bottles is made, the scum and the melted material, we shall then possess in a second instance, (MR. W. PRINSEP's contribution from the iron mines of Burdwan being the first) specimens of a complete Indian mineral manufacture, from the raw material up to the finished production for the use of man.

Additions to the Museum have been as above stated.

Captain Halsled, H. M. S. Childers.—Geological specimens from Cheduba.

A collection of Shells, principally from Cheduba.

Dr. Hunter from Futtyghur through Dr. Angus.—Three green glass bottles from the Futtyghur manufacture, with sample of the mixture from which they are made.

Specimen of the earth from which the Futtyghur fire bricks are made.

7th July, 1841.

H. PIDDINGTON,
Acting Curator, Museum Asiatic Society.

Read letter No. 685, dated 18th June last, from the Secretary to the Government North West Provinces, forwarding Lieut. R. B. SMITH's communication, submitting outline of a project for the elucidation of the Economic Geology of the North West Provinces.

Read also a letter from Lieut. R. B. SMITH, of the 12th June last, received simultaneously with the foregoing, intimating the submission of his project.

Ordered, that the papers be referred to the Committee of Papers for consideration: meanwhile Lieut. SMITH be addressed to send the Tabular Forms prepared by him, said to embrace all points essential to the formation of an estimate of the Economic value of the materials specified and referred to in his letter to Mr. Secretary THOMASON, of 3d June 1841. paragraph 4.

Read a report from the Officiating Curator, of the 1st April 1841, on the Cabinet of Coins belonging to the Asiatic Society.

Read also a letter from Mr. CSOMA DE KOROSI, of 31st March 1841, with a list on the same subject.

Ordered that the papers be referred to a Committee specially selected, for investigation and report upon the subject, with a view to the adoption of measures for preventing the cause of complaint connected with this particular branch of the Society's Museum; and in pursuance of the foregoing resolution, the Officiating Curator, MESSRS. HUFFNAGLE and STIRLING, and Dr. HEBERLIN were selected to form a Committee for the purpose.

Read a letter from Capt. Geo. TWEMLOW, Bengal Artillery, of 18th June 1841, forwarding specimens of black shining ore-like particles, which form on the ground of the table land near the fortress of Gawilghur near Ellichpore after rain, wherever water has run, the ground being of reddish soil, formed apparently from Basalt under decomposition. On inspection of the specimens, they were pronounced by the Officiating Curator to be the common granular Magnetic Iron Ore.

Ordered, that Capt. TWEMLOW be informed accordingly.

Read a letter from Capt. W. E. HAY, of the 7th June 1841, descriptive of an extraordinary Bird he met with among the Eastern Islands.

Read a letter from Lieut. A. CUNNINGHAM, of the 25th June last, on the Inscriptions from the Girnar Rock.

Read a letter from Capt. JACOB, of 15th June 1841, forwarding a Transcript in Nagree characters of the Ancient Inscriptions on the Girnar Rock near Joonaghur, in Kattywar, comprising the Eastern portion of the Rock.

Read also two letters from Lieut. POSTANS, on the products of Khorassan.

The Secretary informed the Meeting, that the subjects treated of in the foregoing papers, would be published in early numbers of the Asiatic Journal.

Read a letter from Mons. E. BURNOUF, of 12th April 1841, acknowledging Moorcroft's Travels, and regretting the interruptions of intercourse between the two Societies, &c.

Read also a letter from the Secretary Linnean Society, London, 10th November 1840, forwarding 3 vols. of the Transactions of the Linnean Society, and noticing the irregularity with which the Asiatic Researches have been received by the Linnean Society, with Memo. of what portions of the publication have been received.

Ordered, that the publications required as presentations be forwarded, and occasion taken to improve the connections of the Society with scientific bodies in England, and on the Continent of Europe.

As connected with the subject, the question for printing the Transactions of the Society was discussed, the printing of which had been neglected for several years from the want of subjects; the magnitude of the expence of printing, &c. In removal of the first objection, the Secretary proposed to place at the disposal of the Committee of Papers such papers as were received by him from

contributors to the Journal for consideration, whether they should be omitted in the Journal to be printed in the Transactions.

Referred to the Committee of Papers for consideration and report.

Read letter from Moulvie ABDULLAH, of 11th June 1841, soliciting the patronage of the Asiatic Society by subscription of his undertaking in reprinting the three volumes of the *Futwa Alumgeri*, a work of great merit and of extensive use in Mahomedan Law.

Also referred to the Committee of Papers for consideration and report.

Read a note drawn up by the officiating Curator, on the examination of some decayed Oriental works in the Library of the Asiatic Society.

A carved Slab, dug up at Gurgoon, was presented by the Assam Tea Company. In forwarding it, the Secretary, Mr. Hampton, writes: "By desire of the Directors of the Assam Company, I have the pleasure to forward for the acceptance of the Asiatic Society, the accompanying carved Stone, received recently from Assam."

Read letter from Rajah KALLEEKRISHNA Bahadoor, of 23rd June 1841, forwarding for the acceptance of the Society, a copy of his English version of Maha-Nataka, a dramatic Hindu work, originally written in Sanscrit, together with the original, and a short account of himself.

Read letter from Mr. Secretary MADDOCK, of the 23th June last, regarding the furnishing of certain instruments required for the Magnetic and Meteorological Observatory, proposed to be established at Lucknow.

Referred to the Officiating Curator for report.

An iron Bar of exact linear measurement for surveying purposes, constructed by the late Mr. James PRINSEP, presented by his brother and executor W. PRINSEP, Esq. was submitted for the inspection of the Meeting.

For all these presentations and contributions, the thanks of the Society were accorded.

TASSIN'S MAPS.

Messrs. P. S. D'ROZARIO and Co. Agents for the sale of Mr. Tassin's Maps, have the pleasure to inform their Friends and the Public, that they are now prepared to execute orders for the above. All orders from the Country to be accompanied by remittance, or reference for payment at Calcutta. The following is a list of Maps published by Mr. T. of which copies mounted and varnished, or folded in cases, are ready for sale.

A new and improved Map of the Provinces of Bengal and Behar, with Benares and adjoining territories, exhibiting the District divisions, the Civil and Military stations and Police Thanas—and likewise the principal Indigo, Silk, and Sugar Works. Compiled from the most recent surveys and best information in the possession of Government and private individuals, by J. B. Tassin, fully coloured, mounted on rollers and varnished.						80
Ditto, ditto, folded in a Case.						72
Map of the Eastern Frontier of British India, with the adjacent countries, comprising Bengal, Bootan, Silhet, Assam, Muneepore, Arracan, Burma, the Tenasserim Provinces, with parts of Siam, and of Yunan in China, by Captain R. Boileau Pemberton, fully coloured, mounted on rollers and varnished,...						70
Ditto, ditto, folded in a Case, ...						64
Map of Eastern Asia, comprising China, parts of Tibet and Mongolia, Bootan, Assam, Burma, and Eastern Bengal, together with Assam, Cambodia, Siam, Laos, the Malay Peninsula and the Indian Archipelago, by J. B. Tassin, fully coloured, mounted on rollers and varnished,...						25
Ditto, ditto, folded in a Case,...						22
Map of the Indus River and of the neighbouring countries, comprising Sind, parts of Beloochistan and Afghanistan, Cashmeer, Punjab, Bhawalpore, the protected Sikh States. Bickaneer, Jessulmeer, and the Western parts of Rajpootana, compiled by order of Government, in the Office of the Surveyor General of India, from authentic and recent materials, ...						30
Anglo-Persian Map of India, by J. B. Tassin,...						36
The same on a reduced scale, with the names in Persian only, by J. B. Tassin, ...						12
Hindusthán ká Nakshá, or Map of India in the Deb Nagree and Roman characters, by J. B. Tassin,						36
Chart of the Coasts of China, drawn and lithographed from Horsburgh's Charts of the Eastern Coast of China and of the Eastern passages to China, with a Map of Pekin, by J. B. Tassin,						14
Chart of the Choo-Keang, or Canton River, and the different passages leading to Macao Roads, drawn from Horsburgh's Chart of the Canton River, combined with Lieutenants Daniel Ross and P. Maughan's Charts of the different passages leading to the Macao roads, with a Map of Macao, by J. B. Tassin,						12
A new and improved Map of various Routes between Europe and India, comprehending Western and Northern Asia, together with Asia Minor and Egypt, by J. B. Tassin,						22
Map of the North-Western Frontier of British India, including the protected Sikh States, Lahore, Cashmeer, Cabul, Herat, Candahar, Shikarpore, and Bhawalpore, together with Sind and Rajpootana, the Indus River, with parts of Beloochistan, compiled from the most recent and authentic materials, by J. B. Tassin,						16
Chart delineating the River Navigation to Assam from the Presidency, by the Soonderbun passage, as well as by the Jellinghee and Matabhangah Rivers, also to Chittagong, Dacca,						

Mymensing and Silhet, compiled from the most authentic materials in the Office of the Surveyor General of India,	32
Map of the Suburbs of Calcutta, East of the Circular Road, from Barnagore to Ballygunge, including Dum-Dum, the Circular Canal, the Salt Water Lakes, and on a smaller scale, the whole line of Eastern Canal to the Eastanuttee river, by Captain Thomas Prinsep,	20
Map of the City and Environs of Calcutta, constructed chiefly from Major Schalch's Map and from Captain Prinsep's surveys of the Suburbs, with the latest improvements and topographical details, by J. B. Tassin,	10
Map of the Soonderbuns and Channels of Inland Navigation, West of Koolna, from the Ganges to the Sea, compiled from the most recent surveys, by Captain Prinsep,	10
Skeleton Maps, exhibiting the principal of the Inland Navigation of the Delta of Bengal, together with the lines of the proposed Rajmahal and Mauga Canals and the Soonderbuns routes, by John Stuart May,	10
Map of Upper Assam, comprising the districts of Joorhat, Luckimpore and Sudyia, shewing the Tea Tracts discovered by Mr. C. A. Bruce, also the Roads proposed to be opened from Sudyia to the Booree Dihing, by J. B. Tassin,	22
Map of the Post Office Stations and Post and Banghy Routes throughout British India, constructed under orders of the Supreme Government of India, for the use of the Post Office Departments of the three Presidences, from materials collected and arranged by Captain T. J. Taylor, by J. B. Tassin,	8
Map of the Territory of Muneepore, with part of the Kulao Vally and Burmese Frontier, by Captain R. Boileau Pemberton,	16
Map of the Countries lying between the 20 and 30 of Lat. and 90 and 99 of Long. shewing the sources of the Irrawady River and the Eastern Branches of the Brahmaputra, comprising Assam and Muneepore, by Lieut Wilcox,	10
Chart of Chusan and adjacent Islands, shewing all the passages and soundings, by R. Richards,	6
Chart of Arracan Coast and Inland Navigation, comprised between Arracan and Sandoway Rivers, by Captain R. Lloyd, I. N.	25
Chart of part of the Tenasserim Coast and Mergui Archipelago, from the surveys of Captain Daniel Ross and Captain R. Lloyd, I. N.,	20
<i>➤ The foregoing, with the exception of the first three Maps in this list, are to be had on rollers or in cases, at the prices noted.</i>	
Maps of Routes from the British Territories into Ava and various other places on the Eastern Frontier, by Captain R. B. Pemberton, 15 plates, folio, bound in cloth	60
Maps of the Rivers Hoogly, Bhaguruttee, Jellinghee, Ganges, and Jumna, from Calcutta to the Himalaya range, compiled from the most accurate surveys, by J. B. Tassin, bound in cloth,	16
A new Map of the Country, 50 miles round Calcutta, by J. B. Tassin, on a board.	3
Map of Simla and the surrounding Hills, by Captain Gardner,	4
Map of Landour and Mussooree, by ditto,	4
Tassin's School Atlas,	3
Map of the Soonderbuns and Environs of Calcutta in Bengallee,	10

To be had also of the principal Booksellers of Calcutta, Madras, and Bombay; likewise of Messrs. McDonald and Co. Simla and Kurnal; Mr. John Ede, Agra; Messrs. Baness and Taylor, Dehli; Mr. E. A. Pittis, Mussooree; and Mr. N. Smyth, Dinapore.

